HEATING AND VENTILATING

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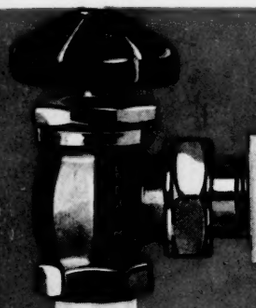


MARSH
MATCHED UNITS
for beauty and economy

With the presentation of this modern, *matched* radiator valve and trap, Jas. P. Marsh & Company establishes a new precedent in the manufacture of heating units.

Marsh engineering is unhampered by the dictates of the past . . . it accepts no previous performance as the standard of perfection . . . it is intent only upon achieving complete superiority in its heating units both in mechanical excellence and in modern beauty of line.

Insistence upon progress has been typical of MARSH policies for over sixty-five years. Upon it we base our claim for recognition as one of the most important contributors to the efficiency and economy of modern heating systems.

A further announcement of MARSH Matched Units appears on the last page of this magazine.

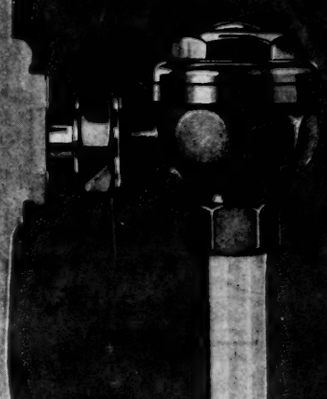
JAS. P. MARSH & CO.

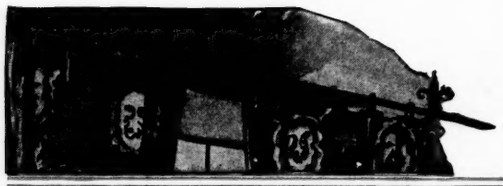
(DIVISION OF COMMERCIAL INSTRUMENT CORPORATION)

Home Office: 2075 Southport Ave.

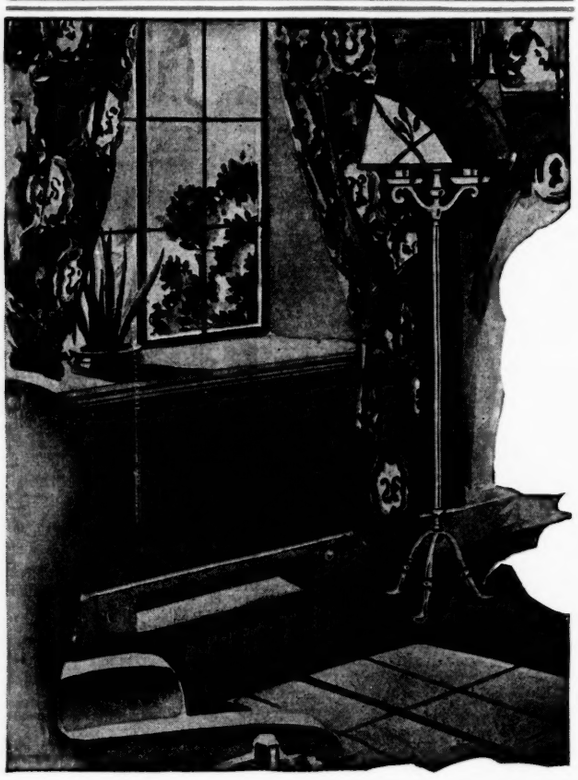
Chicago, Illinois

Marsh System Units





You Don't See These *Smart* Radiators



Shown above is the McQuay Concealed Radiator (in-the-wall) type.

With this type, the entire front is plastered over, only the warm air grille and a narrow opening near the floor being visible.

In 20, 23 and 26 inch heights. For higher air outlets, intermediate stacks can be furnished.

Correct heating practice demands that radiators be placed under, or near, windows. McQuay (*in-the-wall type*) Concealed Radiators can be installed where they belong, without marring the most attractive spots in a room, and occupying useful floor space.

The containing cabinet, which sets into the wall, is sturdily built of a copper alloy steel *which resists rust* to a remarkable degree.

With the All Copper Completely Welded Heating Elements

The heating unit—a distinctive feature of McQuay Radiators—is of **all copper, totally welded,** which greatly increases its heat conductivity, and eliminates chance of leaks that may occur when heating unit is assembled of different metals.

Chosen for many of the finest buildings of all kinds, there are types of McQuay Modern Radiators inexpensive enough for the most modest homes.

Built in Cabinet and Concealed types in a host of capacities and dimensions, there is a McQuay for every heating need. Ask for Bulletins.

McQUAY *Modern* RADIATORS

McQUAY RADIATOR CORPORATION

General Sales Offices, 35 East Wacker Drive, Chicago ***Branches in most principal cities***

v.27, pt.2
Jl-Dec. 1930

KEWANEE

Type "C" Electric-Weld STEEL BOILER

A real Kewanee—designed particularly for those buildings where limitations of space or money demand a compact boiler.

Solidly welded into one unit by the well proved electric metallic-arc-puddling process (*which has been used on the welded details of all Kewanee Products for many years*); with Double Weld for vital seams—the Kewanee Type "C" takes all the "guess" out of welded boilers.

It occupies conveniently shaped space, and requires no excess "head room"—a compact boiler *at an established price of interest to builders*. And it has proved, by every possible test, its ability to make steam efficiently.

1. **The furnace has *extra width and height*, providing perfect conditions for complete combustion.**

2. **Long travel of flue gases—back and forth—gives the water a chance to absorb all useable heat.**

3. **The water content is large, so the heat is absorbed without undue disturbance. The rapid circulation sweeps the steam bubbles through the *free water ways* provided by the improved Kewanee design. The water line remains steady.**

4. **Kewanee design keeps the top flues *always under water*—yet the water line is 3 to 4 inches lower. Ample steam space and large unbroken disengaging areas insure a continuous flow of dry steam into the mains.**

5. **The Corrugated Crown Sheet, built Right-Side-Up, provides more heating surface where it is most effective. It also adds strength.**

Compact in Design
Efficient in Operation
Economical in Price

The Kewanee Line of Steel Boilers is complete—*for every size and type of building*. The staunch steel-riveted Kewanee, which you have known for 40 years: Type "C", compact in design: And Type "R", for homes and smaller buildings. All are built for burning Coal, Oil or Gas. Ask for Catalogs.

Tapped for Excelso Water Heater

KEWANEE BOILER CORPORATION

division of American Radiator & Standard Sanitary Corporation

KEWANEE, ILLINOIS

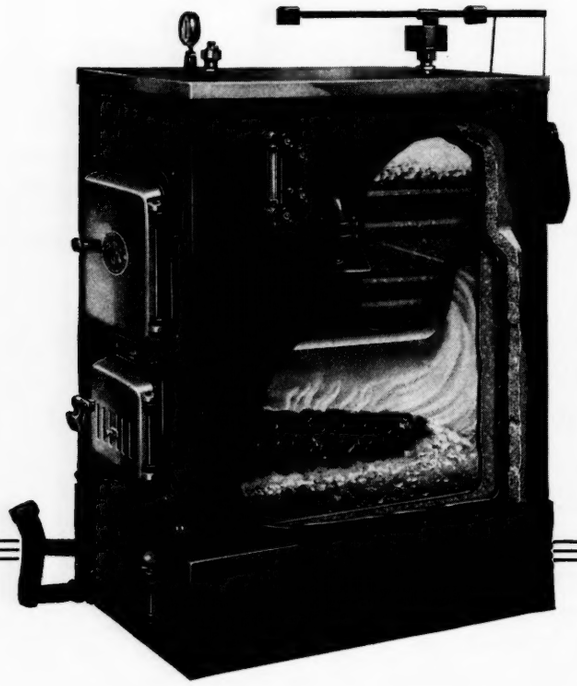
MEMBER OF STEEL HEATING BOILER INSTITUTE

Branches in Principal Cities

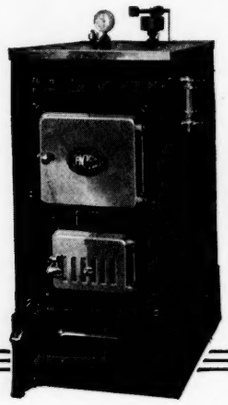
278127

HEATING AND VENTILATING, *formerly* THE HEATING AND VENTILATING MAGAZINE, published by BUILDING DIVISION of NATIONAL TRADE JOURNALS, INC., at 521 Fifth Ave., New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single Copies, 30 cents. Vol. XXVII, No. 7, July, 1930. Entered as second-class matter, April 18, 1925, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Copyright 1930, by NATIONAL TRADE JOURNALS, INC.

· Here's the RED CREST ·



This sectional view of the Red Crest gives a hint of the interior engineering that makes the Red Crest a better, more economical heater.



Jacketed in steel, with a handsome coat of baked-on enamel, the new Pacific Red Crest takes second place to none in appearance; and there's Pacific Welded Steel quality beneath the jacket.

. . . . new jacketed Pacific Welded Steel Boiler for Residences!

NO need to tell the quality of Pacific Welded Steel Boilers. Their lasting construction and better design have been thoroughly proved in all types of buildings, wherever they have been used.

Now this quality is offered in a boiler exactly meeting the most modern demands on residence heaters . . . the Pacific Red Crest, jacketed with steel, enameled in glowing red and blue, insulated in fine rock wool.

Beauty and adaptability to houses large or small has been added . . . and not one jot of sheer practical heating merit and durability that has won Pacific Welded Steel Boilers their fame has been sacrificed. The Red Crest is all steel, all joints welded; fire box unusually large for thorough combustion; the heating surface designed to give the largest amount of direct fire contact. The forced water circulation sweeps heating surfaces free of air bubbles and gives maximum transmittal of heat units to the water; every part is accessible for easy cleaning. The sum of all these is low first and last cost; fuel economy, work economy, and above all long life and dependability.

The Red Crest is easily installed in basements with ceilings of average height. The larger sizes are readily knocked down and taken through any door in separate units. The vast modernizing market is opened to this better boiler. Now you can use the Pacific Steel Boiler for any residence installation, in any home old or new.

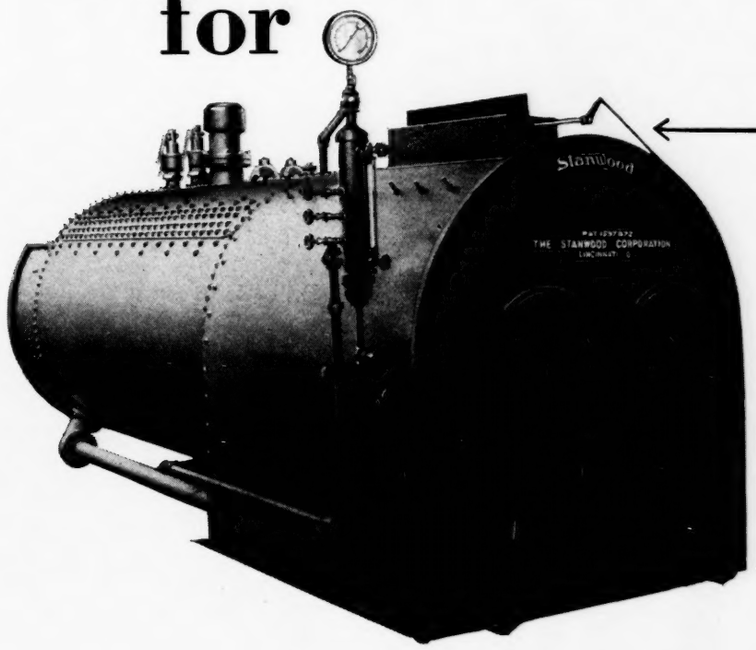
Write us for full particulars.

THE PACIFIC STEEL BOILER CORPORATION
General Offices: Detroit, Michigan
Factories: Waukegan, Ill., Bristol, Pa.
Sales Offices in 58 Cities
Division of the United States Radiator Corp., Detroit, Michigan

Steel Heating Boilers PACIFIC *and Capitol Radiators make a logical combination*

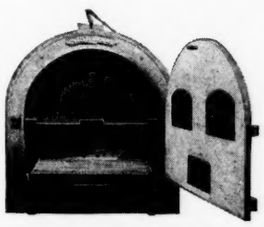
PACIFIC
STEEL HEATING BOILERS

"Engineered" for



Height of boilers, floor to top of shell—64 to 97 inches—depending on size. Length (overall) 14½ to 26 ft. Width (overall) 66 to 104 inches.

Low Headroom . . .



Front of boiler swings open like a door. The interior is instantly accessible. Cleaning is expedited. Shutdown for cleaning a matter of hours only. Brass plugs opposite each water-grate tube permit inspection.

Compact . . . . to fit the very minimum of low headroom . . . . without sacrificing accessibility; designed to squat close to the floor . . . . ideal for shallow basements and places where excavation is out of the question.

Stanwood Engineers designed the Stanwood Steel Riveted Smokeless Boiler for the difficult conditions frequently met with in boiler installations. The very little headroom requirement assures its adaptability to many installations where other boilers cannot possibly be installed without expensive excavation.

Because of its lowness, the Stanwood possesses a water line of 48″ to 75″ from the floor, depending on size; fire doors are at the correct height for firing; and the entire boiler can be cleaned in less than twenty-four hours. The Stanwood is a unit that makes operation dependable—is easy to install—and provides an economy that is lasting and worth investigating.

STANWOOD PRODUCTS

Steel Riveted (Low Water Line) Heating and Power Boilers
Steel Welded (Compact) Heating Boilers
Horizontal Return Tubular Boilers

Write Dept. D-730 for Bulletins

THE STANWOOD CORPORATION

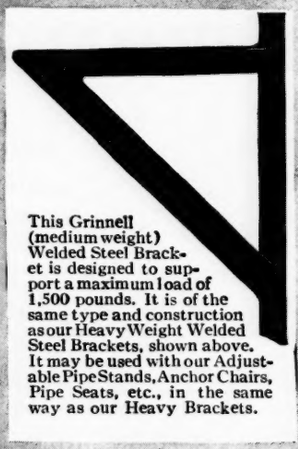
Boilers for Every Need

Est. 1891—Cincinnati, Ohio

THERE IS A GRINNELL FOR EVERY NEED

Grinnell (heavy weight) Welded Steel Brackets are designed to support a load of 3,000 pounds, yet are light in weight as compared with the usual cast iron bracket.

The Adjustable Pipe Stand shown with the Bracket is adjustable as to height by simply adjusting bolts on the roll stand. Lateral adjustment or movement is also possible with this Adjustable Pipe Stand by sliding the stand on the Welded Steel Bracket.



This Grinnell (medium weight) Welded Steel Bracket is designed to support a maximum load of 1,500 pounds. It is of the same type and construction as our Heavy Weight Welded Steel Brackets, shown above. It may be used with our Adjustable Pipe Stands, Anchor Chairs, Pipe Seats, etc., in the same way as our Heavy Brackets.

NEITHER the steamfitter nor the local blacksmith has the proper equipment to produce hangers economically.

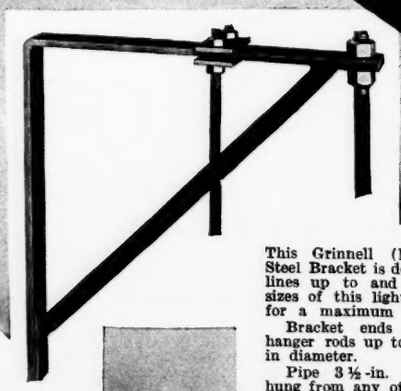
Large contractors will not stand for the expense of brackets and hangers made on the job. Nor will they take chances on their unknown strength. That is why so many specify Grinnell hangers. They know that there is a size and model in the *complete* Grinnell hanger line for every construction need.

Grinnell swivel hangers are self-locking and they stay locked at the level where they are set. To level a line takes only a few seconds.

Grinnell Universal I-Beam Clamp Hangers of forged steel are being specified by engineers for suspended floors, ceilings, conduits, etc., as well as for pipe lines.

Write for the Data Book

You will find the Grinnell Pipe Hanger Catalogue No. 5 and Engineering Data on Pipe Fabrication

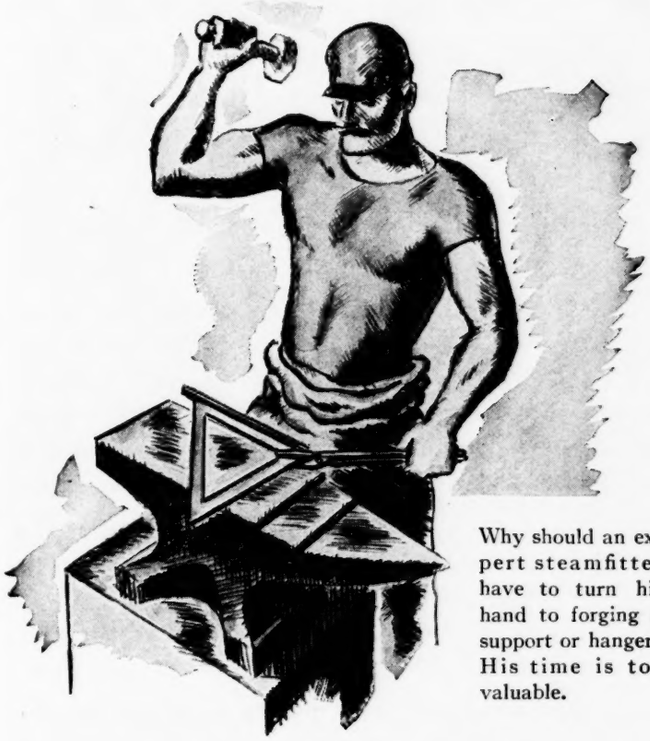


This Grinnell (light weight) Welded Steel Bracket is designed to support pipe lines up to and including 6-in. All sizes of this light bracket are designed for a maximum load of 750 pounds.

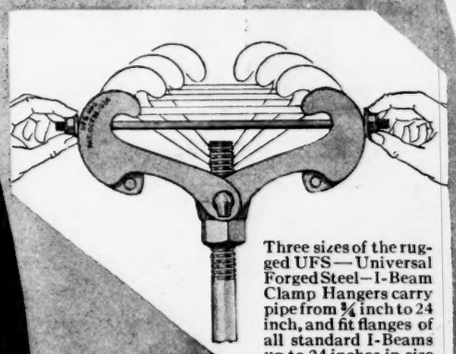
Bracket ends are drilled to take hanger rods up to and including ¾ in. in diameter.

Pipe 3½-in. and smaller may be hung from any other point on the horizontal member by using the Grinnell Steel Bracket Clip, shown at midpoint on the horizontal member.

GRINNELL HANGER FOR CONSTRUCTION NEED



Why should an expert steamfitter have to turn his hand to forging a support or hanger? His time is too valuable.



Three sizes of the rugged UFS — Universal Forged Steel — I-Beam Clamp Hangers carry pipe from ¾ inch to 24 inch, and fit flanges of all standard I-Beams up to 24 inches in size — truly adaptable to every conceivable condition in pipe line support.

Book valuable for their ready reference tables covering pipe hangers and supports, fabrication data, etc. and the Grinnell Universal Forged Steel I-Beam Clamps. Write for your copy of either one or both. Address Grinnell Company, 265 West Exchange Street, Providence, R. I.

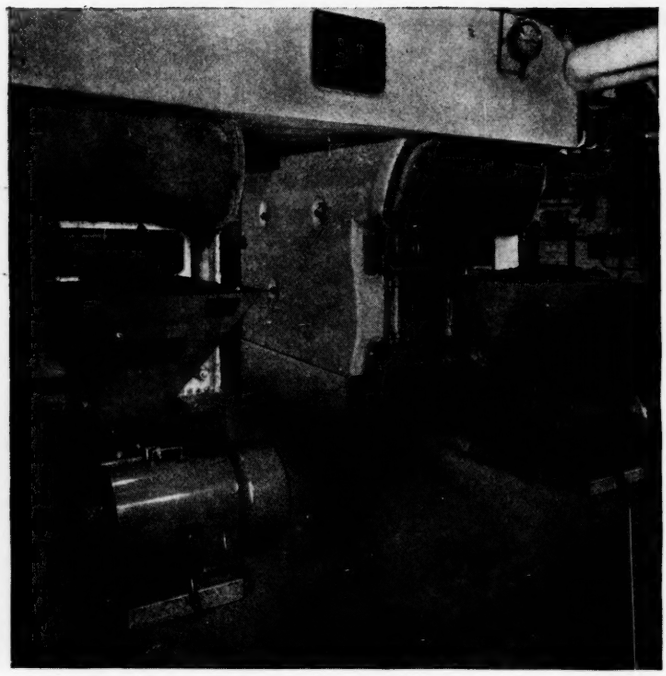
Grinnell Adjustable Swivel Hangers lock themselves at the level where they are set. They are self-locking and they stay locked.

GRINNELL COMPANY

Executive Office: Providence, R. I.

Branches in all Principal Cities

$1.80 a ton saved



Two Detroit Junior Stokers at Detroit Golf Club

THE MANAGEMENT OF DETROIT GOLF CLUB REPORTS:

"We have cut the cost of boiler room operation considerably with Detroit JUNIOR Stokers. We are now buying a cheaper coal and are saving $1.80 a ton on the delivered price. We also burn fully 20% less coal.

"As the stoker furnishes automatic heat with little attention we are able to dispense with one man in the boiler room. This saving alone amounts to $1,800 a year.

"Our stokers will easily pay for themselves in one year's time."

• *You, too, can save money with Detroit Stokers. A type and size for every service. For Detroit* JUNIOR *Stokers, ask for Bulletin 373* •

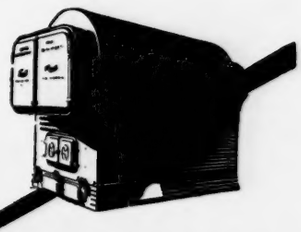
DETROIT STOKER COMPANY
Third Floor General Motors Building
DETROIT • MICHIGAN

Detroit Golf Club

DETROIT JUNIOR STOKER

A TRIUMPH IN COMBUSTION ENGINEERING

ROSS



STEEL BOILERS

Architects, Engineers
and Heating Contractors
are using Ross Steel Heating Boilers
because they are superior in design,
easy to install, do not require frequent
attention and are quick steaming,
economical in operation and durable
in construction.

The FROST MANUFACTURING COMPANY
GALESBURG ILLINOIS

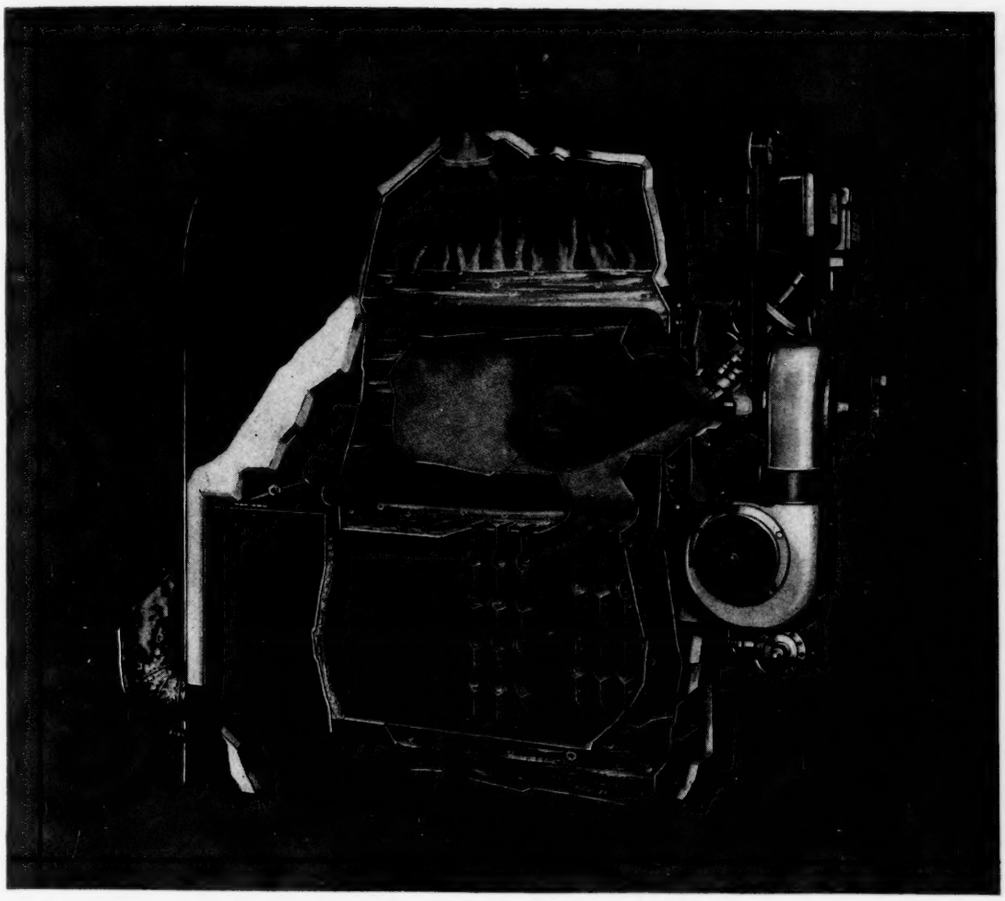
THEY SAID IT COULDN'T BE DONE.....

It was unheard of... this building a boiler like an automobile radiator. It had never been done before... this placing the greatest heat in contact with the smallest portion of the water *at the top* of the boiler—and then exposing the cooling gases to the coldest sections of the water, *at the bottom* of the boiler. "Why that's turning the boiler upside down," they said. "It can't be done."

But that's exactly what the makers of the Gar-Wood did... the usual methods of boiler design were totally disregarded. And then an oil burner was built especially for the boiler... a burner as revolutionary as the boiler... a burner that really atomized the oil fuel and burned it *in suspension*—without a refractory surface.

The boiler and burner were then engineered into one complete balanced heating unit. Long and exhaustive tests were conducted at the University of Michigan... and finally a number of these units were installed in private homes where their practical efficiency has been proved beyond any doubt.

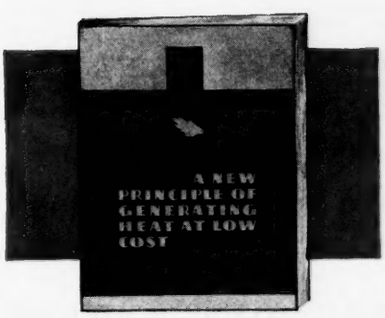
The efficiency of the Gar-Wood balanced heating unit is almost unbelievable. Where the ordinary boiler, coal fired, has an average



efficiency of 50 per cent... and the ordinary boiler, oil fired, is about 65 per cent... the Gar-Wood develops such a remarkable over-all efficiency that burning oil at 10 cents per gallon, it will furnish heat at a cost not to exceed $8.00 coal. The Gar-Wood is easy to install and maintain... yet its first cost is decidedly moderate.

A new book, with valuable information on oil and gas heat, mailed free if you will fill out and mail the attached coupon.

Gar-Wood



GAR WOOD ENGINEERING CO.
4196 Bellevue Ave., Detroit, Mich.

Gentlemen: Send me... without cost or obligation... a copy of "A New Principle of Generating Heat at Low Cost."

Firm Name.....

Address.....

City..... State.....

Requested by.....

THE ONLY PICTURES THAT COUNT ARE OF ACTUAL INSTALLATIONS

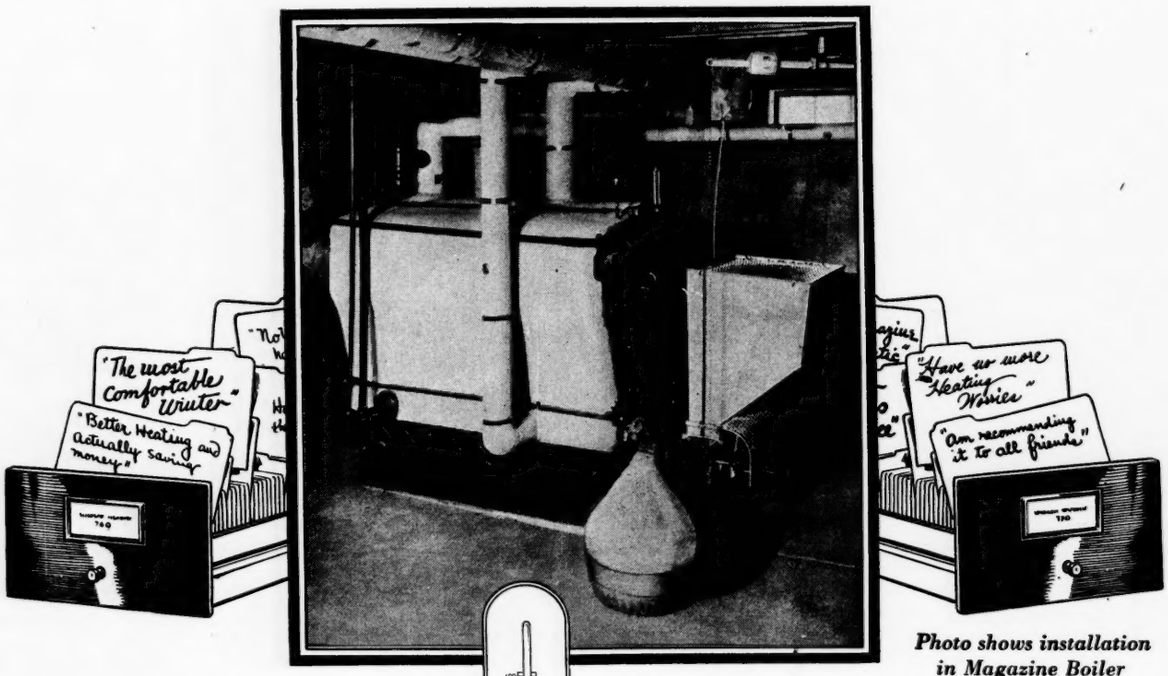

"The most Comfortable Winter"
"Better Heating and actually saving money"
"Have no more Heating Worries"
"Am recommending it to all friends"

Photo shows installation in Magazine Boiler

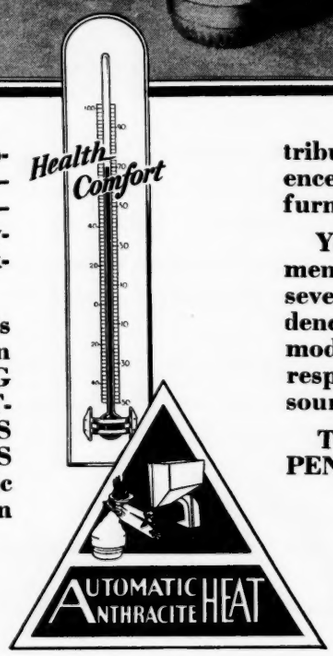
IN MORE THAN 10,000 HOMES—representing every type of heating plant—steam, vapor, hot water and warm air—The ELECTRIC FURNACE-MAN is proving its right to leadership on its remarkable service records.

The ELECTRIC FURNACE-MAN is adaptable to any heating system now in use — MODERNIZING COAL BURNING FURNACES AND BOILERS, CONVERTING GAS AND OIL BURNER BOILERS AND MAKING MAGAZINE BOILERS AUTOMATIC. There is no domestic heating job for any size of home in which you cannot recommend the ELECTRIC FURNACE-MAN with absolute confidence.

In over 325 cities authorized ELECTRIC FURNACE-MAN Distributors and Dealers will give you experienced service—making heating surveys and furnishing estimates of installation costs.

You are not asked to support an experiment. More than 10,000 satisfied users—several in your community—furnish evidence of the superior heating service of this modern method. It is guaranteed by a responsible organization with ample resources.

The ELECTRIC FURNACE-MAN burns PENNSYLVANIA ANTHRACITE in the economical Buckwheat sizes—automatically feeds the coal—removes the ash to a sealed container and maintains uniform heat at lowest cost. No smoke, smudge or odor. SAFE, CLEAN and DEPENDABLE. Familiarize yourself with the facts.



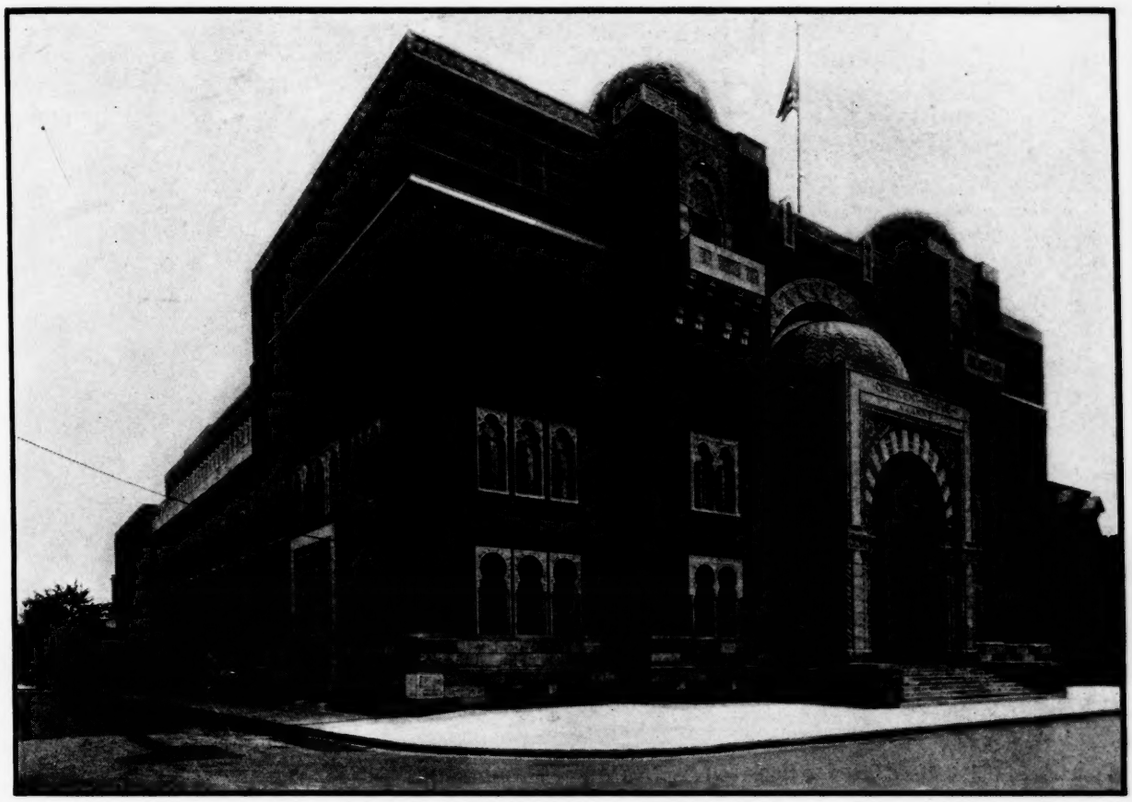
The Electric Furnace-Man

(Patented Automatic Coal Burner)

ENDORSED BY ANTHRACITE OPERATORS CONFERENCE — A BILLION DOLLAR INDUSTRY

AUTHORIZED DISTRIBUTORS AND DEALERS IN OVER 325 CITIES

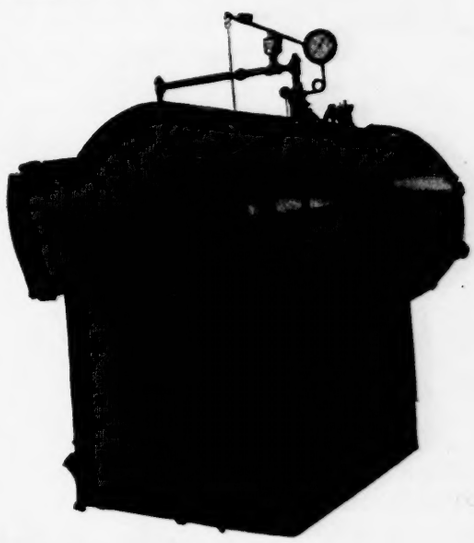
DOMESTIC STOKER COMPANY, 7 DEY STREET, NEW YORK



CRESCENT TEMPLE, TRENTON, N. J.

COATESVILLE BOILERS comprise the heating plant in the Crescent Temple.

They are designed for correct and efficient heating and are highly regarded by owners, architects, engineers and heating contractors.



Walter Hankin, *Architect.*
J. Osborne Hunt, *Associate Architect.*
Calvert & Barnes, *Mechanical Engineers.*
Benj. E. Labov, *Heating Contractor.*
The General Contracting & Construction Co., *Builders.*

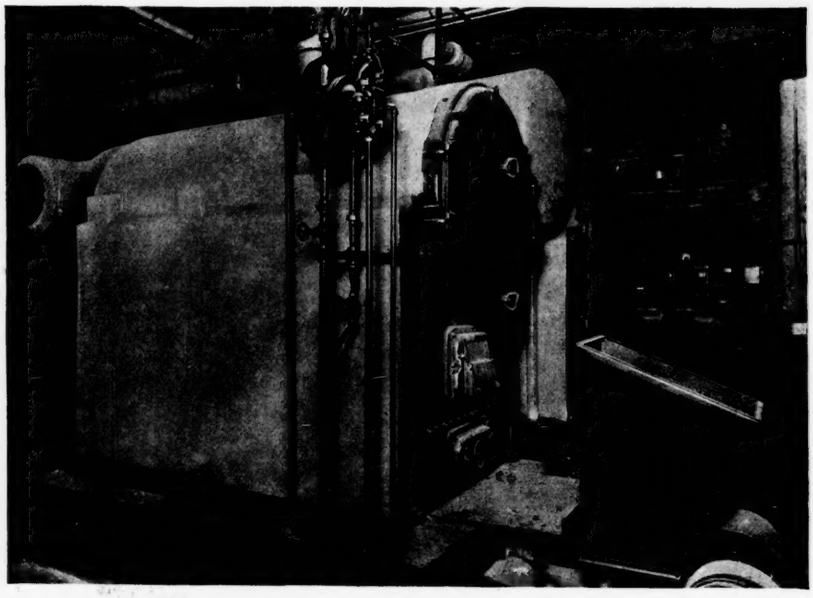
COATESVILLE BOILERS

Boilers - Tanks - Steel Plate Work

A Coatesville All Steel Welded Heating Boiler

Main Office and Works—COATESVILLE, PA.

Philadelphia 111 S. 15th St.	New York 30 Church St.	Newark 60 Park Place	Boston 141 Milk St.	New London 325 State St.	Pittsburgh Union Trust Bldg.
	Baltimore Lexington Bldg.	Washington, D. C. 208 Evans Bldg.		Richmond, Va., Railway & Power Bldg.	
Newport News, Va. 3100 Virginia Ave.	Bristol, Tenn-Va. 607-609 State St.	Greensboro, N. C. North Carolina Bank Bldg.	New Orleans 617 Common St.	Dallas, Texas 1505 North Haskell Ave.	Houston, Texas 1604 Kensington Ave.



Two McDonnell & Miller Self-Cleaning Duplex Feeds installed on Pacific Boilers equipped with "Iron Firemen." W. S. Adams, Heating Contractor; R. N. Hunt, Architect.

The most *vital* job in the boiler room

WHAT job in a boiler room compares in importance with maintaining the proper water level in the boiler? What job asks as big a penalty for failure to handle it properly?

This matter of watching the water line is the easiest thing for a man to overlook—the last thing that should be trusted to the slender, easily snapped thread of human memory. It is a job for a mechanical device with a memory of cast iron and bronze!

—and the *toughest* job

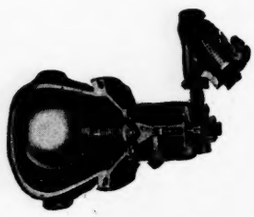
Even when handled mechanically, the maintaining of the boiler water line is a tough job. That is why we have said repeatedly that "only the best boiler feeder is good enough." When the circuit to the condensation pump fails, the feeder you specify or install must be capable of feeding the entire feed water requirements of the boiler. It must do this always—even when the water is hard or rank. Isn't this a job that should only be entrusted to a *self-cleaning* feeder—a feeder with rotary valves that "stay new"?

A Practical Necessity With Automatic Firing

On the oil or gas fired job the boiler water line problem looms still bigger. Automatic firing encourages neglect of the water line. What protection against this neglect is quite so logical and effective as the McDonnell & Miller Self-Cleaning Duplex Feeder? It not only protects the boiler from low water, but also protects the owner and tenants from shut-downs of the burner and the trouble, and expense that always accompanies shut-downs. This fact is each day taking deeper root. Many prominent engineers are insisting that every oil or gas fired job be equipped with a McDonnell & Miller Self-Cleaning Duplex Feeder.

Send the coupon for facts.

McDONNELL & MILLER, 1314 Wrigley Bldg., Chicago
Eastern Office: Grand Central Terminal New York, N. Y.



Now a lower priced feeder for smaller boilers

The New McDonnell No. 30 Safety Feeder is made for protecting the smaller boiler against low water. Its lower price is due to the smaller size and ingenious simplicity. Use the coupon to request facts about it.

McDONNELL & MILLER
SELF-CLEANING
Duplex Feeder
"Doing one thing well"

McDonnell & Miller,
1314 Wrigley Bldg.,
Chicago.

Please send facts covering feeders checked:
McDonnell & Miller Self-Cleaning Duplex Feeders.
McDonnell Safety Feeder.

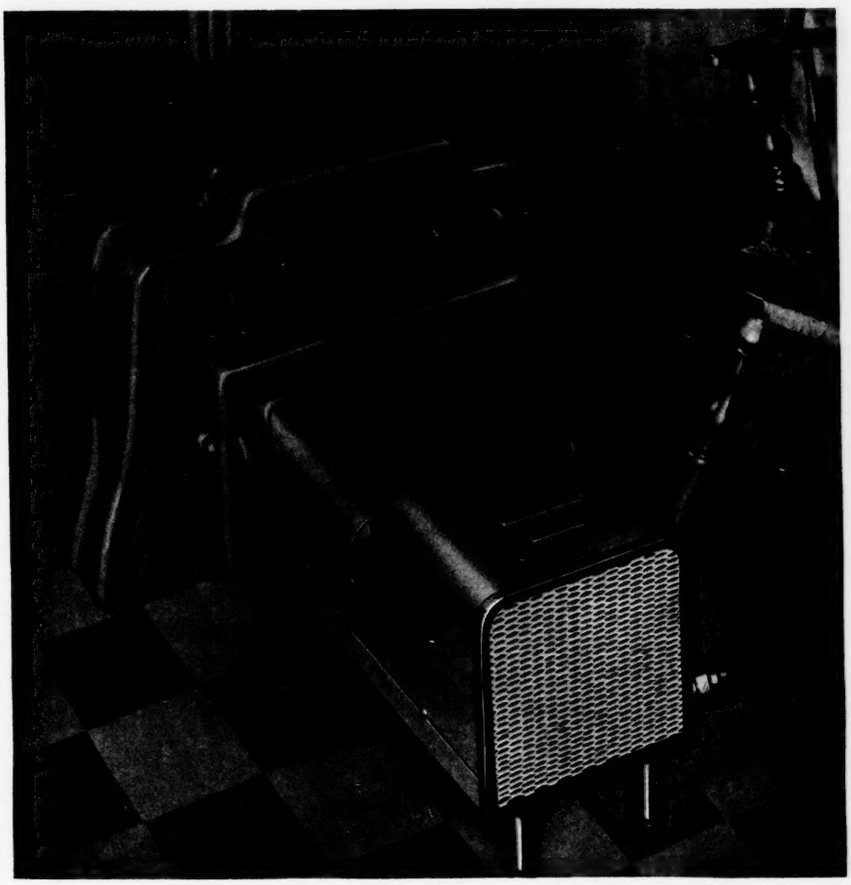
Business.....
Individual.....
Street and Number.....
City and State..... HV7

How

Mr. Conger made $7,500.00

TWO years ago Mr. E. M. Conger, a plumbing and heating contractor, decided to enlarge his business and after careful investigation took on the KLEEN-HEET oil burner line. Mr. Conger lives in an Illinois city of only 7,000 population. So his field of operation is limited. Yet last year his volume on KLEEN-HEET netted $7,500.00 profit.

Mr. Conger's success is gratifying but it is not in any sense extraordinary. A great many of our dealers, recruited from other lines, have had similar experiences.



Prominent among the reasons for the success of our dealers are (1) KLEEN-HEET has the most complete line of oil burners in America; (2) KLEEN-HEET is the oldest company in the business and has built up a tremendous good will and acceptance for its name; (3) KLEEN-HEET supplies invaluable help on getting started, how to get and follow up prospects, furnishes sales and merchandising helps. KLEEN-HEET dealers stick to KLEEN-HEET because they make money.

New York Office: 11 West 42nd Street.

Clip the coupon and mail it today

Kleen-Heet

OIL BURNER

Winslow Boiler & Engineering Co.,
844 Rush St., Chicago, Ill.

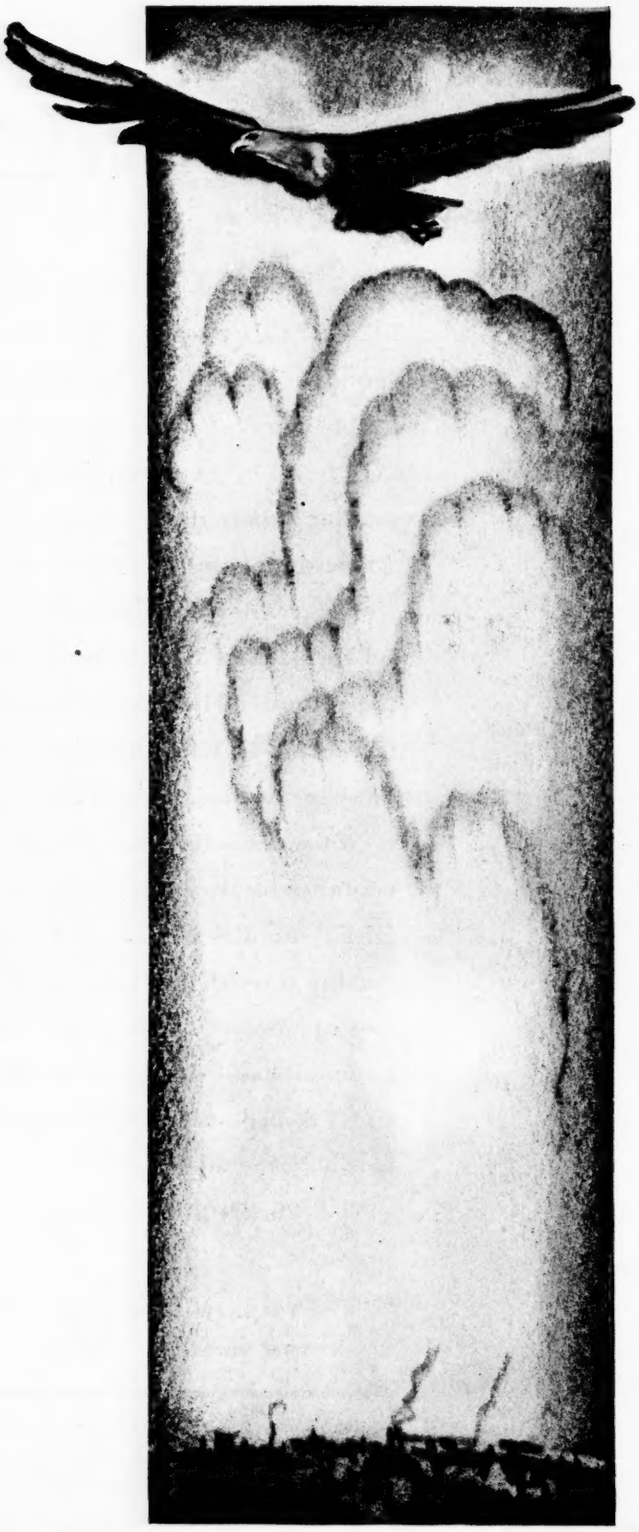
I am interested in your KLEEN-HEET proposition. Please send further details.

Name_____

Address_____

City_____ State_____

"Silent" Sales Reach—



New Heights

. . . *Even Higher Than 1929*

Winning new customers . . . satisfying old ones . . . strengthening public preference . . . Silent Automatic has sold more oil burners during the first five months in 1930 than during the same period last year.

More and more business men, the country over, attracted by Silent Automatic's commanding position of leadership, are finding that selling "Silent" is highly profitable.

The opportunities afforded by a Silent Automatic dealer franchise were never better. Actual sales figures definitely point to the conclusion that 1930 will be Silent Automatic's biggest year . . . far surpassing 1929, when world leadership was achieved.

This is the sort of organization to "hook up" with. Progressive business men who seek a rich field for the investment of their capital and ability . . . will do well to investigate the unusual opportunities offered by Silent Automatic.

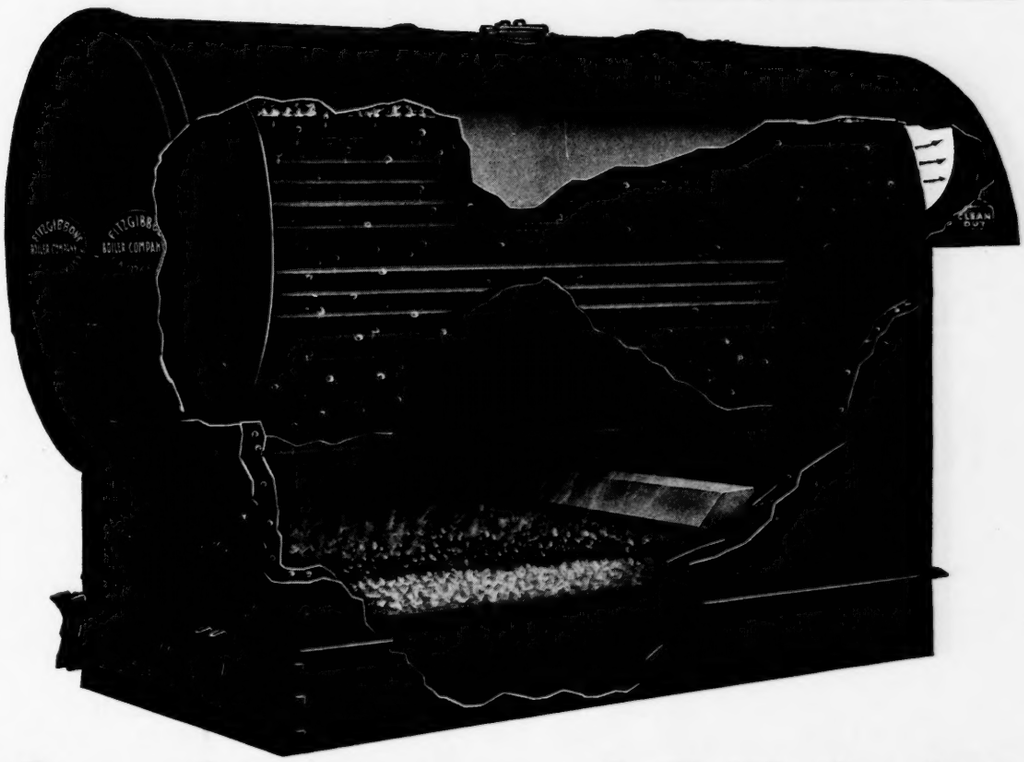
SILENT AUTOMATIC CORPORATION
12001 East Jefferson Avenue
Detroit, Michigan

(310)

SILENT AUTOMATIC
THE NOISELESS OIL BURNER

R-Z-U FITZGIBBONS FIREBOX BOILER

REAR SMOKE OUTLET



has all the advantages of Z-U design *with* rear smoke outlet

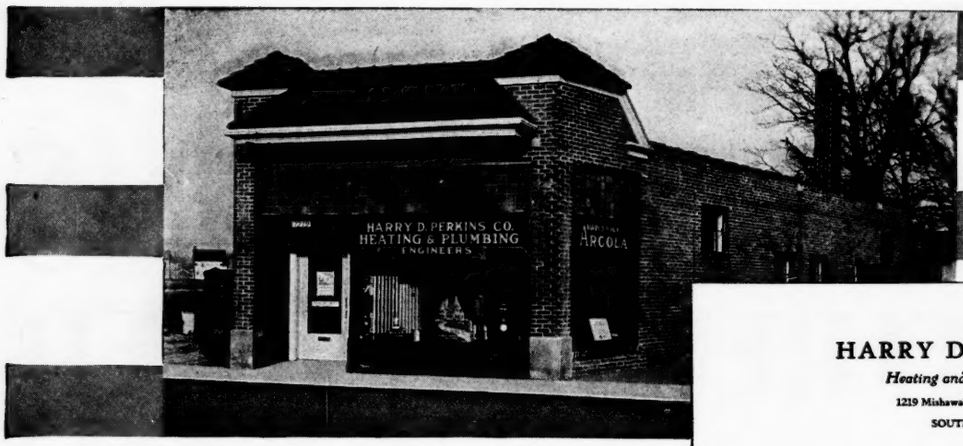
R-Z-U Boilers are built for steam or hot water heating, and for all fuels—large and small sizes of anthracite, bituminous, coke, and for oil, gas or stoker firing. Sizes, from 4,000 to 34,000 sq. ft. radiation.

R-Z-U designates the popular and efficient Z-U Firebox Boiler, adapted in design to meet the requirements of installations where space conditions make it desirable to place the smoke outlet at the rear.

It is a big jump ahead in rear smoke outlet boiler design. One-piece fire tube cylinder, inherently the strongest construction known, with strength everywhere uniform, is only one of its many decisive advantages. *R*-Z-U Bulletin gives them all. Write for a copy—today.

FITZGIBBONS BOILER CO., Inc.
General Offices: 574 Seventh Ave., NEW YORK, N. Y.
Works: Oswego, N. Y.
Branches and Representatives
Cleveland Columbus Grand Rapids Raleigh San Francisco
Columbia, S. C. Detroit Pittsburgh San Antonio
for Central, Southern and Western States

Sold by **KEWANEE BOILER CO., Inc.**
General Offices: 574 Seventh Ave., New York
Sales Branches
Baltimore Buffalo New York Richmond Washington
Boston Newark Philadelphia Syracuse
in New England and Middle Atlantic States, Virginia and District of Columbia



HARRY D. PERKINS CO.
Heating and Plumbing Contractors
1219 Mishawaka Ave. - Phone 2-2165
SOUTH BEND, INDIANA

Jan 23rd,1930

The American Radiator Co
Indianapolis, Ind.

Gentlemen:-

During the past year we have installed twenty seven All American Jobs in residences in South Bend. Of these eleven have been the single pipe vacuum jobs.

A recent cold spell where the temperature dropped to twenty degrees below zero gave them a very good test and not a job was found wanting.

Yours very truly

Harry D. Perkins

"20 *degrees below zero,* and not a job found wanting"

THE heating contractor whose attractive shop is shown above has found that "All-American" heating systems give real satisfaction.

Whether your work is on a new building or whether you are modernizing an old one it will pay you to standardize on American Radiator products just as Mr. Perkins does. It will pay you too, to become a qualified user of our time payment plan which gives you your money at once and your customer two years to pay.

Have you listened to the American Radiator Birthday Party? It is on the air every Thursday night, 9 to 9:30 Eastern Daylight Saving Time, over station WEAF and affiliated stations of the National Broadcasting Company. It is real entertainment, and besides, it is telling your customers how to modernize their heating equipment.

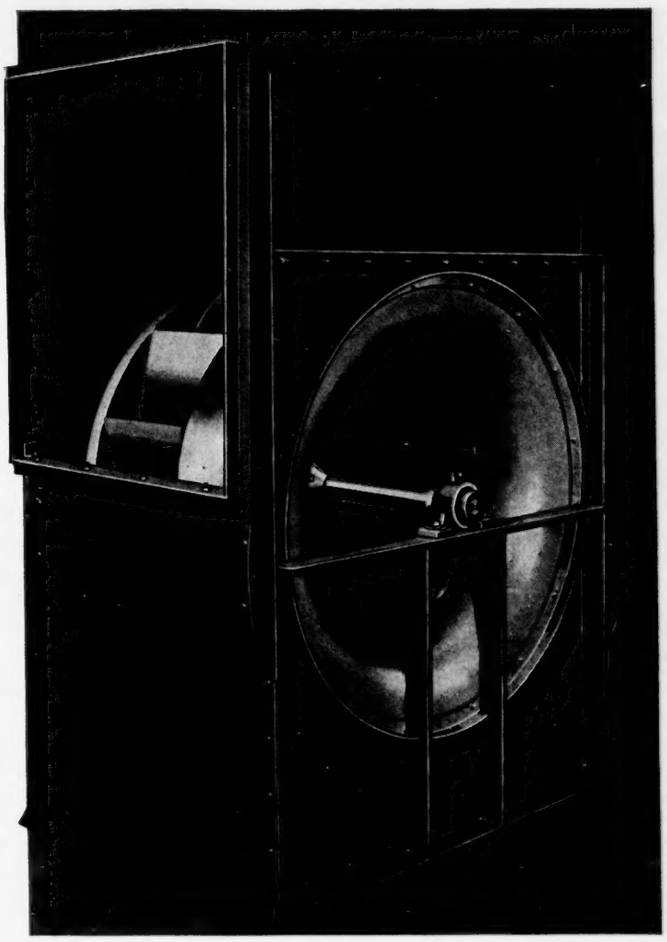
AMERICAN RADIATOR COMPANY

40 WEST 40th STREET, NEW YORK, N. Y.

Division of

AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

STREAMLINE
POWER FIXED
FANS



QUIET OPERATION!

Extremely low outlet velocities.

Generous dimensions of the scrolls and housing.

Elimination of rivets and projections in the wheel. Sturdy construction throughout.

Careful and proper design of the blades, the inlet cone, the hub, and air passages in accordance with aero-dynamic principles.

These enable the Streamline Fan to operate quietly at speeds high enough for direct connection to standard motors.

High efficiencies over a wide range and a non-overloading horse power characteristic are also noteworthy features resulting from the scientific design of the streamline fan.

The BISHOP & BABCOCK SALES COMPANY, Cleveland, O.

General Offices – 4901-4915 Hamilton Avenue, N. E.

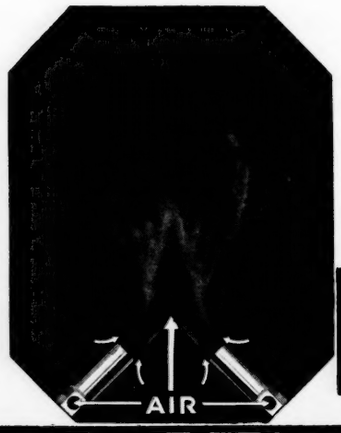
SALES AND SERVICE OFFICES

Baltimore Boston Washington, D. C. Bridgeport St. Louis Buffalo Chattanooga Chicago Cleveland Birmingham, Ala. Denver Detroit Little Rock Los Angeles Minneapolis Duluth Memphis Pittsburgh New York Oklahoma City San Antonio Philadelphia Miami, Fla. Nelsonville, Ohio Orlando, Fla. Springfield, Ill. Winston-Salem, N. C. Richmond Spokane Cincinnati Tulsa Tokyo, Japan

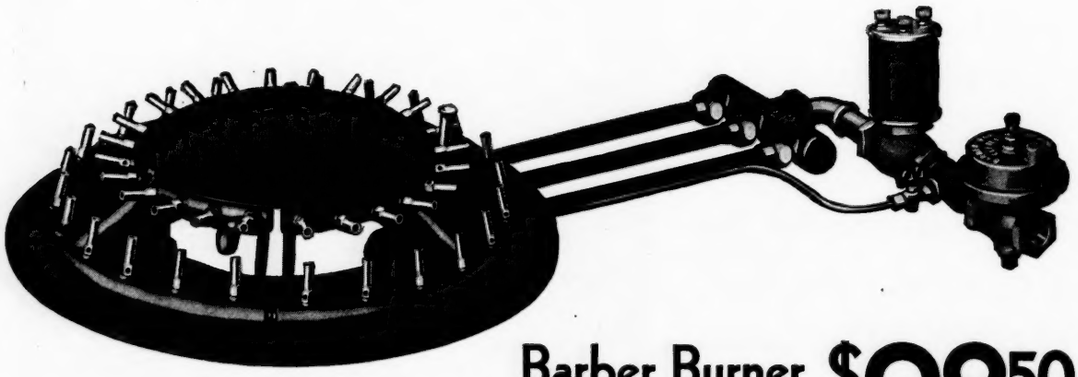
BISHOP & BABCOCK

TEMPERATURE REGULATION
HEATING SPECIALTIES VENTILATING EQUIPMENT

The perfect combustion or burning of gas is dependent upon its union with a proper amount of oxygen as may be extracted from the air. Note how the exclusive, ingenious BARBER PATENTED JET PRINCIPLE accomplishes perfect combustion, liberating all the heat contained in the gas.



ONLY MAKE THIS



1→

Barber Burner No. 324-A $98.50

2→

Fully Automatic and Completely Equipped.
For Grate Dimensions of 18 to 20 inches incl.

3→

Those who are qualified to judge say that this new Barber Burner line will make a great nation-wide increase in gas heating.

If you are interested in Conversion Gas Burner sales write for Complete Information and new Sales Data.

NOTHING FINER CAN BE SAID ABOUT ANY GAS APPLIANCE

BARBER COULD ANNOUNCEMENT

A new line of Conversion Gas Burners has been developed using the famous Barber Patented Burner principle. This line of Burners presents the following features:

The lowest price ever offered for a high-grade fully automatic Conversion Gas Burner.

High operating efficiency that challenges comparison from gas burning apparatus of any kind or price.

Unequaled simplicity of installation and operating reliability.

THAN THAT IT IS EQUIPPED WITH BARBER BURNERS

THE BARBER GAS BURNER CO.
FORMERLY THE CLEVELAND GAS BURNER AND APPLIANCE CO.
3702 SUPERIOR AVENUE « » CLEVELAND, OHIO

Under any Standard Boiler

Whiting Model C (Low Set) Stoker under 150 H.P. Oil City water tube boiler; Wilson Steel Products Co., Chicago, Illinois.

a Profitable Investment

The Whiting Automatic Stoker (formerly the King Coal) makes central station stoker service available for all boilers of 25 to 250 H.P.—Fire Box, Cast Iron, H.R.T. or Water Tube.

With its low setting height, the Whiting Stoker can readily be installed with low set boilers and ample combustion space provided to assure high efficiency and greater ability to carry overloads. A recent survey by disinterested engineers showed only 1.4% of combustible material in the ash of a Whiting Stoker. Capacity is increased 50% as compared with hand firing.

Operation of the Whiting Stoker is completely automatic, reducing boiler room labor to a minimum. Ash is discharged automatically and continuously.

The Whiting Stoker burns the cheapest sizes of coal, smokelessly and efficiently, with savings which soon pay for the installation.

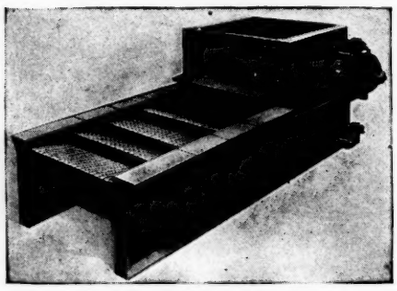
This Stoker is Saving $3600 Yearly

Mr. E. M. Barber, Superintendent, Wilson Steel Products Co., Chicago, writes:

"Since December the Wilson Steel Products Company has been burning Southern Illinois screenings on a Whiting low-set stoker instead of Indiana nut coal and saving $1 a ton on the cost of the coal alone. The potential yearly savings are estimated at $3,600, but will probably be more, due to increased efficiency. Hand-firing was employed when the nut coal was burned.

"The boiler, under which the stoker is installed, is one of 150 h.p. but is operated constantly at overloads ranging between 125% and 175%. Despite the overloading an average CO_2 content around 12% has been maintained. At present there is a large heat loss out of the chimney, because of the inability of the boiler to absorb the overloading. Otherwise a saving in amount of coal per pound of steam would be realized. Smoke has been entirely eliminated.

"When this stoker—5 ft. 6 in. x 6 ft.—was installed, less than 30 hours were required for all the work involved in placing it in position ready for work. Being of a low-set type a minimum of setting height was needed and few structural changes had to be made."



Whiting Stoker (Patented)

In your plant too, the Whiting Stoker will save money—how much, depends on your conditions. Write for literature and tell us the size and make of your boilers.

Joseph Harrington Co. Subsidiary

WHITING CORPORATION

15699 Lathrop Ave., Harvey (Chicago Suburb) Illinois

WHITING STOKER

Joseph Harrington, Engineer

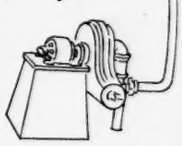
Specify Duplex ... Individual room temperature control

The Duplex Unit Control Gas Heating System assures the right temperature at the right place at the right time. Gas is burned in the radiator in a partial vacuum. The fumes of combustion are exhausted by means of an electric pump operating in the basement. For highest efficiency in the utilization of gas heat, the Duplex System is incomparable.

THE importance of the right heating system for the modern home, office building, church or auditorium, warrants unlimited attention. Safety, economy and maximum heating results justify the specification of the Duplex Unit Control Gas Heating System.

Not only does Duplex Heat mean economical heat—but it means individual room temperature control entirely automatically. For instance, with the Duplex System, the living room of a home may be heated at 70 degrees, while the bathroom is 80 degrees. Or the nursery may be heated at 75 degrees, while the spare bedroom is 60 degrees. Each room has its own individual thermostat, which automatically regulates the heat in that room no matter what the heat is in the rest of the home.

Modern buildings require modern heating methods — and when you specify the Duplex Unit Control Gas Heating System — you not only get away from all noise, dust and dirt—but you have the added advantages of safety, economy and individual room temperature control. It is modern in every respect. Send for complete information on the Duplex System. There is no obligation.



From a decorative standpoint, the Duplex Unit Control Gas Heating System fits in with any scheme of home decoration. The entire system is compactly housed in a handsomely finished metal cabinet.

ROBERTS-GORDON APPLIANCE CORPORATION

DELAWARE AVENUE AT TUPPER STREET

CURTISS BUILDING BUFFALO, N. Y.

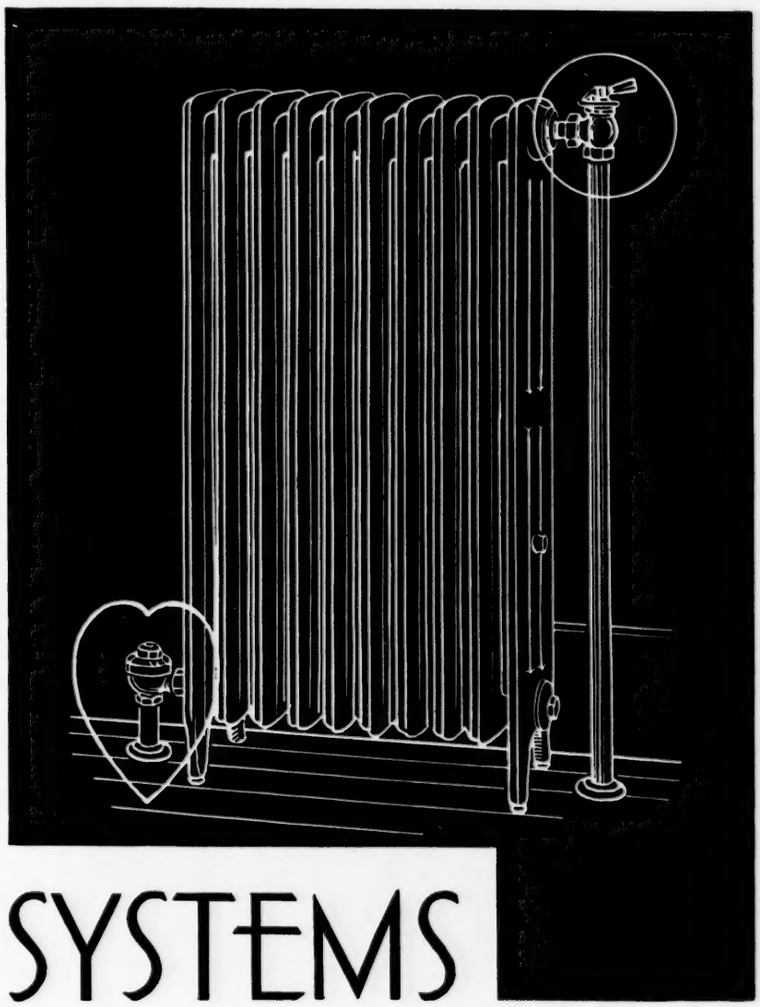
TRADE MARK

DUPLEX UNIT CONTROL GAS HEATING SYSTEM

The specifications of every office and loft building requiring 10,000 sq. ft. or more of direct radiation should call for heating "Controlled-by-the-weather" with a Webster MODERATOR System of Steam Heating. This new development is heating typical modern office and loft buildings with results which warrant investigation. For details write Warren Webster & Company, Camden, New Jersey.

a mod-8

WEBSTER MODERATOR SYSTEM OF STEAM HEATING "Controlled by the weather"



. . . . . THE HEART OF THE HEATING SYSTEM IS IN THE VALVES

QUALITY HEATING SYSTEMS

In a modulation vapor or vacuum heating system satisfactory operation depends, to a great extent, on two visible valves. To be sure, there are other traps and apparatus, below floors, which aid in insuring the proper functioning of the system. Correct layout, too, is imperative. Yet most of the burden rests on the supply and return valves. The latter is really the "heart" of the heating system.

EXPERIENCE MAKES FOR PERFECTION

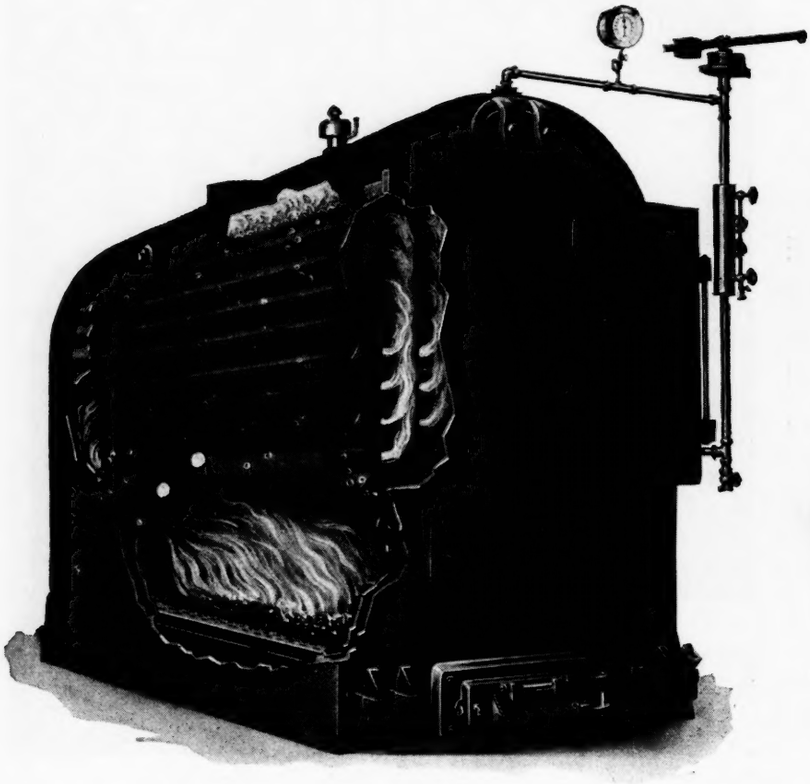
Thirty years' experience in the development, manufacture and installation of heating systems has taught us that Quality, in design, workmanship and materials, is the only pattern to perfection. Quality alone will insure satisfactory operation and permanent efficiency in a heating system. That is why we stress Quality.

MODULATION
VAPOR
VACUUM

The Sign B&J of Quality

BARNES & JONES
INCORPORATED
128 BROOKSIDE AVE., BOSTON . . . . 101 PARK AVE., NEW YORK

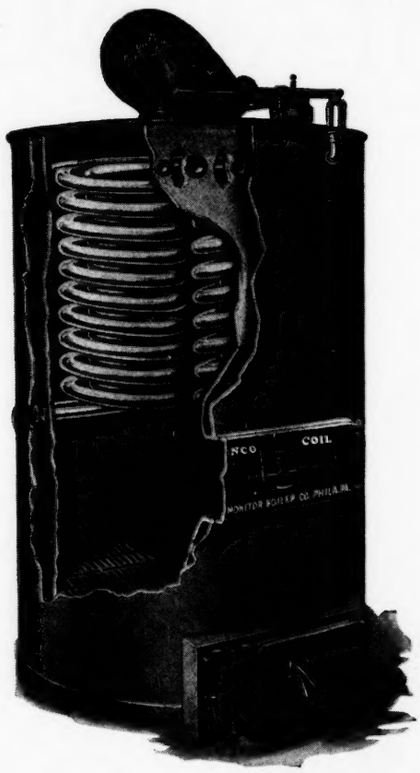
MONCO



STEEL HEATING BOILERS

for

COAL OR OIL BURNING



MONCO

COIL HEATING BOILERS

COIL WATER HEATERS

for

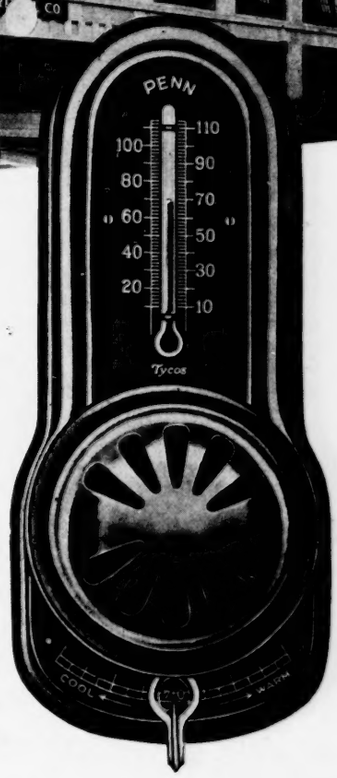
COAL OR OIL BURNING

MONITOR BOILER CO., 1505 Race St., Philadelphia, Pa.

Affiliated with UNITED DRY DOCKS, INC., NEW YORK

THE PENN THERMOSTAT FOR UNIT HEATERS

Simplified CONTROL

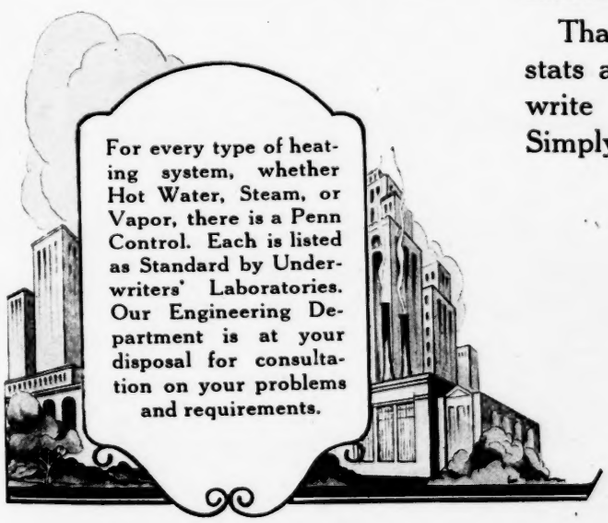


IN one of the World's Largest Garages, the Brown of Des Moines, the wiring job on the Unit Heater System was comparatively simple. Penn Thermostats made the hook-up without the use of relays, transformers, or magnetic contactors. Employing the unique Penn Magnet Structure, fragile mercury tubes are eliminated. The mounting was easy and quick, no plumb and level needed.

Day and night a steady stream of traffic pours in and out of this 1,250 car capacity garage. The brunt of excessive drafts and temperature changes caused by constant opening and closing of doors is thrust upon the controls.

Yet, even under these severe conditions, Penn Thermostats assure dependable, accurate operation.

That you may see the simplicity of Penn Thermostats and prove their performance, we suggest you write for a standard thermostat. No obligations. Simply address,


For every type of heating system, whether Hot Water, Steam, or Vapor, there is a Penn Control. Each is listed as Standard by Underwriters' Laboratories. Our Engineering Department is at your disposal for consultation on your problems and requirements.

PENN ELECTRIC SWITCH CO.
DES MOINES, IOWA

PENN
AUTOMATIC CONTROLS

A Complete Line of Automatic Electric Switches for
OIL BURNERS UNIT HEATERS GAS AND ELECTRIC HEATERS
PUMPS AND AIR COMPRESSORS

Now Trane Concealed Heat Sells in the Price Range

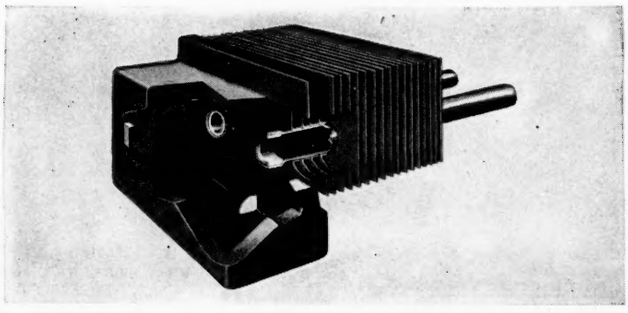
To the engineering and architectural professions and the heating trade—

We are happy to announce at this time that Trane Concealed Heaters, "The Successor to the Radiator", can be installed in *every* type of building at a total cost in the price range of cast iron radiators.

To be able to offer our Concealed Heaters at these low prices without the slightest sacrifice in quality or heating efficiency is a source of real pride to us. It has been made possible through many helpful suggestions from engineers, architects and heating contractors. Sound design-engineering has simplified our heating element and our installation requirements to the point where volume production is possible. And volume production is the secret of low prices.

As heating engineers we take genuine pleasure in telling you that though we know how to make a more expensive concealed heater, we do not know how to make a *better* one.

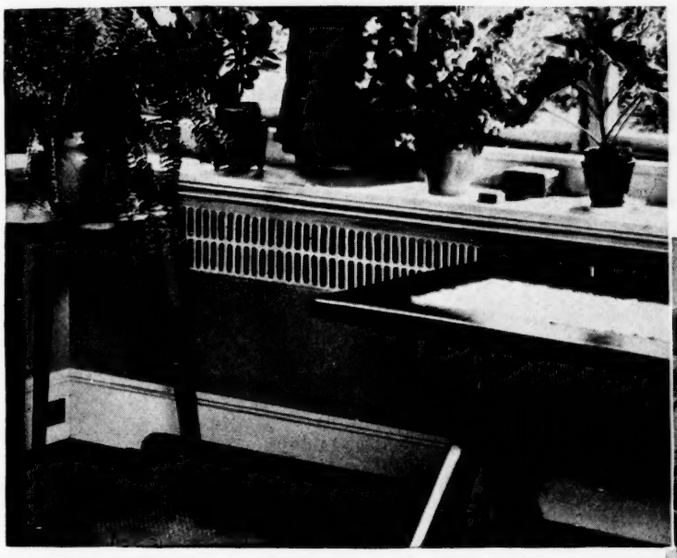
Reuben H. Trane



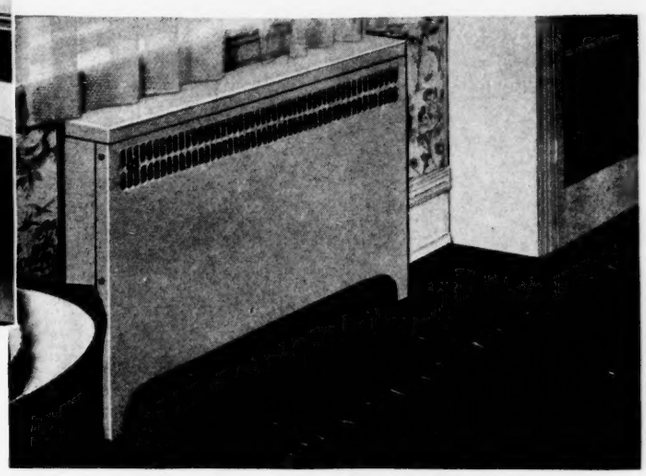
The Trane patented Heating Element is constructed for maximum heat transfer per unit of surface and per pound of weight. There are no soldered, brazed or welded joints. Copper tubes rolled into cast iron headers in typical boiler fashion, for absolute protection against expansion and contraction failure.

TRANE
SPECIALISTS
IN HEATING

for *every* Type of Installation of Cast Iron Radiation



Trane Concealed Heater (plaster front model)



Trane Concealed Heat in Cabinet form, ideal for modernizing the heating of large buildings and homes now standing.

Today even the smallest home can enjoy all the benefits of modern heating with this strong, correctly engineered, economical concealed heater . . . . . .

On March 15, heating men were startled by the public announcement of Trane Concealed Heat sold in the price range of cast iron radiation for large buildings.

Engineers, architects, heating contractors said it could not be done. But it was done. And it was merely a prelude to the announcement Trane makes today. Now Trane Concealed Heat for *every* type of building —offices, apartments, hotels, hospitals, large homes, small homes—sells in the low price range of old-fashioned radiators.

Simplified design has produced the modern Trane Heating Element, a heater that for strength, heating efficiency, durability and unfailing satisfaction challenges the world. Simplified design makes volume production possible. And simplified design makes possible this low price that places modern, efficient, dependable concealed heat within the reach of everyone.

And in Trane Unit Heaters and Trane Blast Heaters this heating element is the reason for that rare combination of low price and unchallenged quality.

Mail the coupon today for detailed information.

THE TRANE COMPANY, Dept. 7
206 Cameron Ave., LaCrosse, Wisconsin

Send complete information about low cost Trane Heating for
☐ Large Buildings, ☐ Homes, ☐ Factories, ☐ Manufacturing Processes

Name _____

Company _____

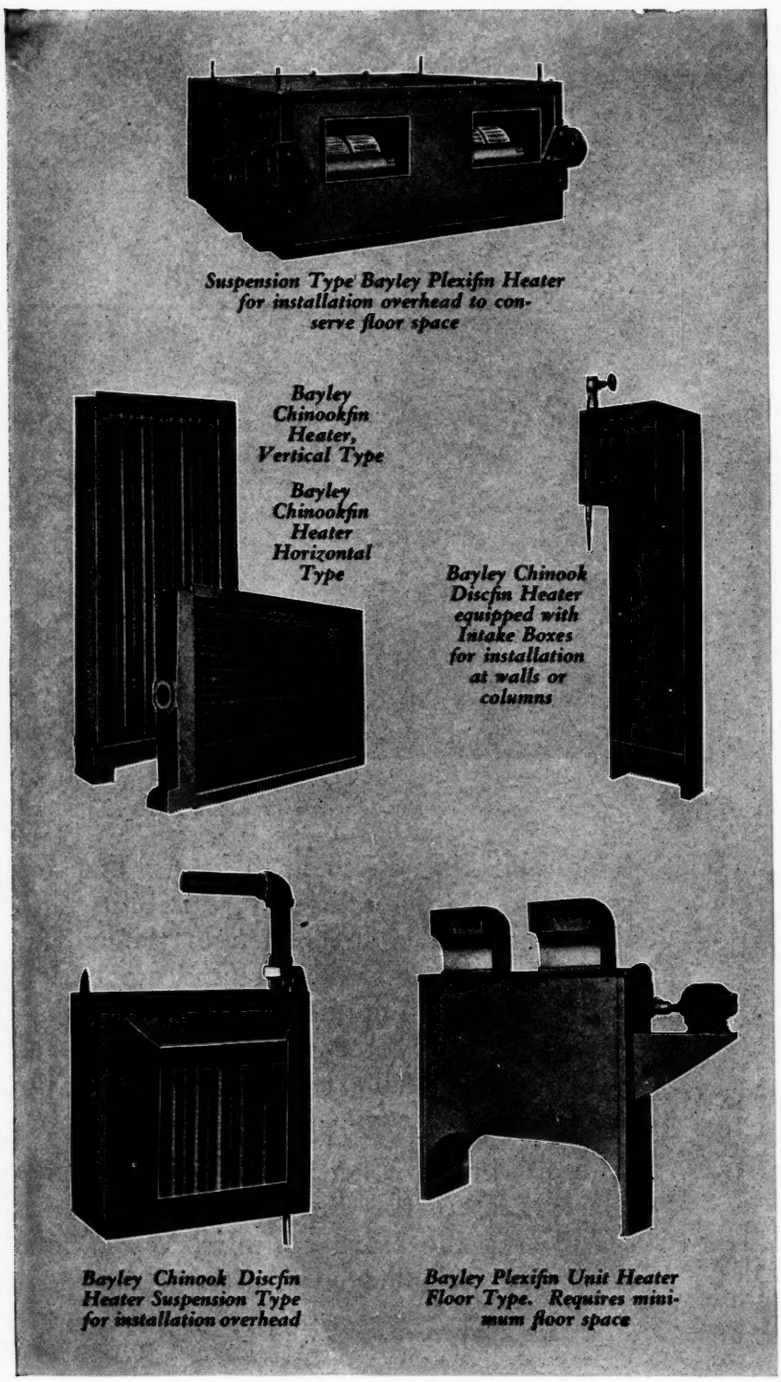
Street and No. _____

City _____ State _____

In Canada address Trane Co. of Canada, Ltd., Toronto, 2, Ontario

HEAT MACHINES!

for Every Requirement



Suspension Type Bayley Plexifin Heater for installation overhead to conserve floor space

Bayley Chinookfin Heater, Vertical Type

Bayley Chinookfin Heater Horizontal Type

Bayley Chinook Discfin Heater equipped with Intake Boxes for installation at walls or columns

Bayley Chinook Discfin Heater Suspension Type for installation overhead

Bayley Plexifin Unit Heater Floor Type. Requires minimum floor space

ONE type of unit heater won't serve all purposes. Conditions vary with the building construction, amount of window area, location, and other factors. Your plant or structure present an individual problem which must be individually solved. Bayley has developed and perfected a line of unit heaters sufficient to meet the widest range of heating conditions. Bayley engineers will be glad to help you find the one best solution for your particular problem—let us hear from you.

BAYLEY BLOWER CO.
742 Greenbush St. Milwaukee, Wis.

Fans — Heaters — Air Washers — Unit Heaters — Heating, Ventilating, Drying, Air Conditioning, Humidity, Control, Mechanical Draft.

Bayley

UNIT HEATERS

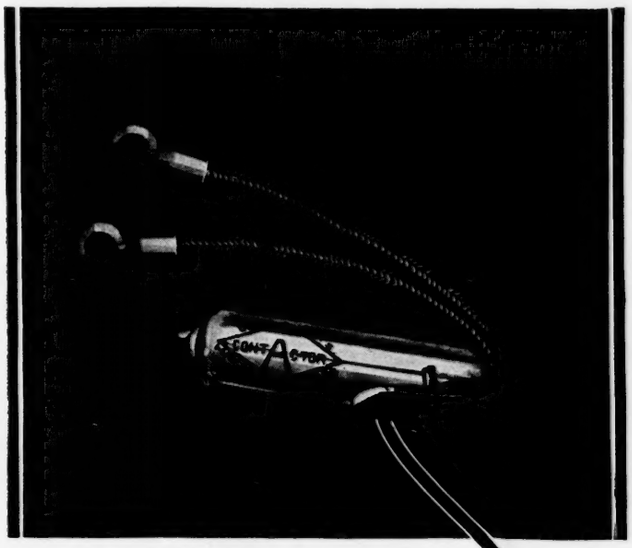
Why TIME-O-STAT MERCURY SWITCHES *are Important to You* ▲▲▲

THE *Switch* is the heart of all electrically-operated automatic controls.

Time-O-Stat Controls have Con-Tac-Tor Mercury Switches. Because of their high switch capacities and simple, sturdy switching mechanism, Time-O-Stat Controls provide trouble free automatic operation. There are no open contacts to burn or wear out, to corrode or catch dirt.

The No. 184 Fanswitch — at the right — is an efficient, durable, automatic fan control, operated by a Mercury Switch. It regulates fan operation to provide even, economical heat, and to prevent the circulation of cold air.

Send the coupon for detailed information on Time-O-Stat automatic controls — with Mercury Switches.



The Con-Tac-Tor Mercury Switch is an exclusive Time-O-Stat product.

The No. 184 Fanswitch — note the long thermal tube that goes right into the heat zone.

TIME-O-STAT CONTROLS COMPANY

ELKHART, INDIANA

Branch Offices:
Chicago, New York, Boston, Detroit, Kansas City.
Export Department: New York.
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Manufacturers of AUTOMATIC CONTROLS *for all types of Burners—Electric Refrigerators — Furnace Fans — Industrial Ovens — Ice Machines — Unit Heaters . . . also of Sign Flashers — Mercury Switches — Electric Heaters — Corrugated Metal Bellows.*

TIME-O-STAT CONTROLS COMPANY Dept. 3G
Elkhart, Indiana

Without obligation to me, send at once detailed information on the No. 184 Fanswitch — and other Time-O-Stat Automatic Controls.

Name.....

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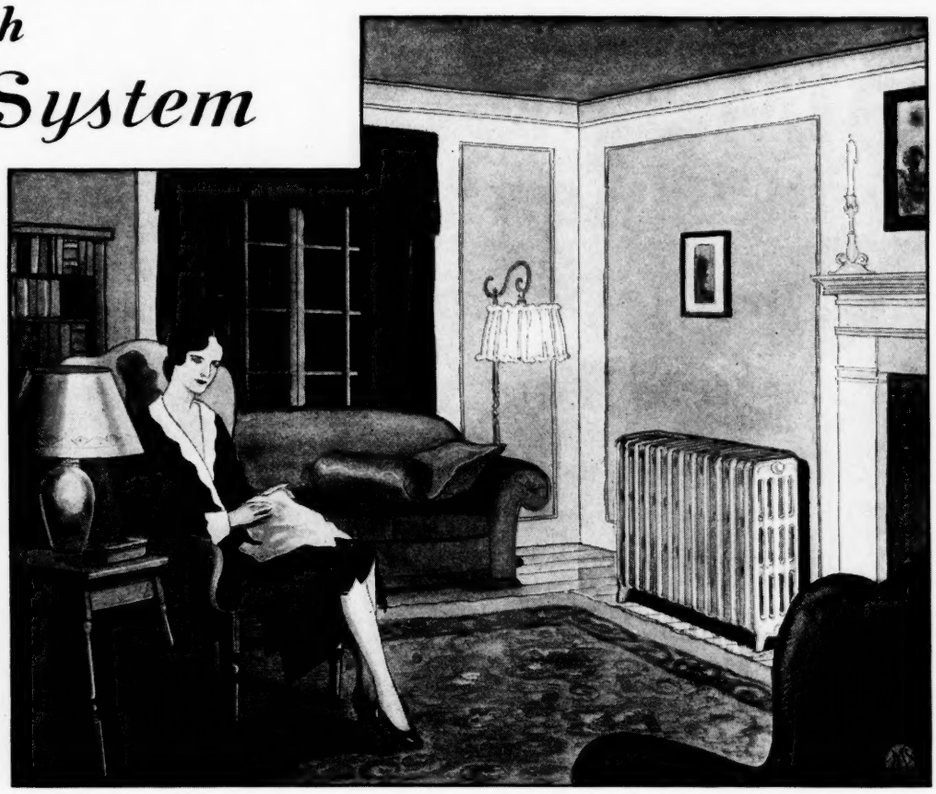
Company.....

HEALTHFUL HOT WATER HEAT
with
Thrush System

Automatic Operation

Even Distribution of Heat

Fuel Economy



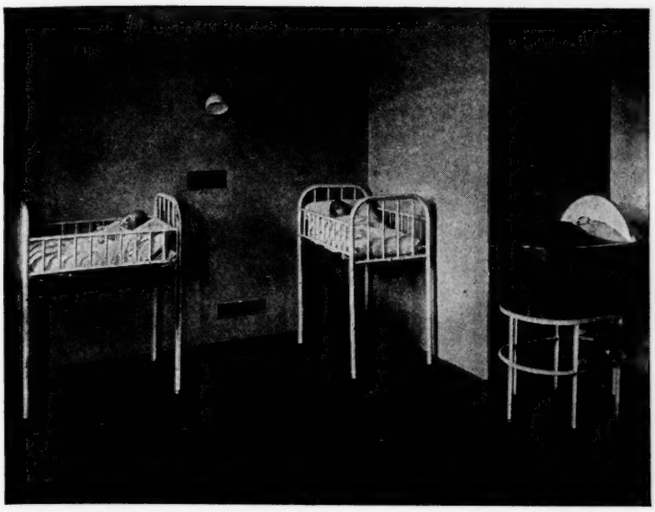
The Thrush Differential Pressure Relief Valve
(GUARANTEES SAFETY)

Here's what THRUSH SYSTEM offers .... Fewer Doctor Bills .... Less Fuel Cost .... Automatic Operation .... Added Comfort .... Absolute safety. And, the first cost is negligible—reduction in pipe sizes oftentimes offsets the cost of THRUSH SYSTEM.

Write today for our new catalog. It is *"chuck full"* of valuable data. *Address*

H. A. THRUSH & CO.
PERU, INDIANA

THRUSH SYSTEM
Of Hot Water Heating

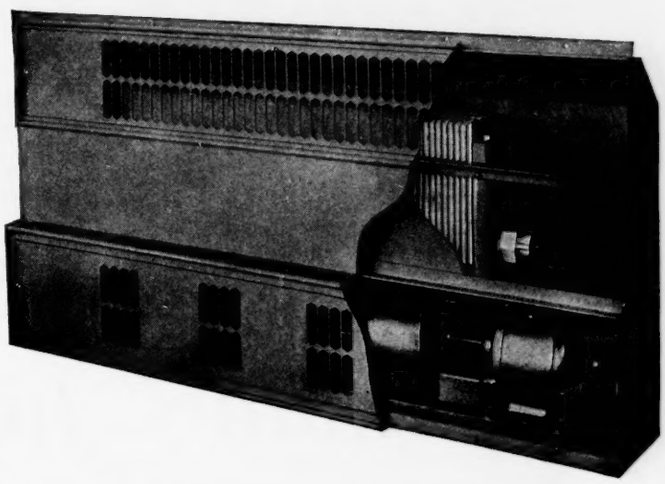


Aeriet - - - Brings Health as well as Comfort

THE Air-Way Aeriet-equipped room is always filled with fresh pure air. The desired temperature is obtained without depreciating the air quality. Diffusion of warmth or coolness is gentle, almost imperceptible, but positive and complete.

The cooling effect of air in motion is achieved without the discomforts of drafts and strong currents of air. Desired warmth is produced almost instantly and is equably distributed throughout the entire living area.

Architects and heating and ventilating engineers recognize in the Air-Way Aeriet an outstanding contribution to human health, as well as comfort and convenience. Wholly concealed, still it offers no installation, operation nor maintenance problem. It easily meets economic requirements.



The all-electric Aeriet makes the use of electricity as fuel practicable and economical. The steam, hot water, or vapor Aeriet gives these familiar heat elements a far greater efficiency than any other form of radiation. Investigate the Aeriet.

Complete information sent promptly on request

AIR-WAY ELECTRIC APPLIANCE CORP., Toledo, Ohio

HEATING SYSTEMS DIVISION

Air-Way
TRADE MARK
AERIET

Use This Coupon

Air-Way Electric Appliance Corporation
Toledo, Ohio
Please send me the Air-Way Aeriet book.

Name .....

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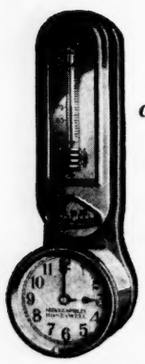
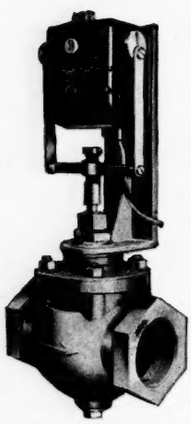
H-V

Why you need "*tailor-made*" heat control that fits your *whole* plant



Clock Thermostat

Surface Aquastat



Motorized Regulating Valve

The "human machines" which determine the quantity and quality of your production—and even your profits or loss—do not work so well when they are either cold or overheated. Yet in thousands of industries, one part of a plant will often be chilly while another is overheated, due to inadequate heat regulation.

The remedy is in group control of direct radiation or of unit heaters, or in individual control of each radiator or unit heater, as provided by Minneapolis-Honeywell regulation. Such a system can be "tailor-made" to fit your requirements exactly, giving ideal temperatures in each department at the same time that it reduces fuel consumption.

A free copy of our booklet on Unit Heater and Sectional Control Systems is yours for the asking. The experience of our engineering staff is also at your disposal.

The coupon is for your convenience.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2715 Fourth Ave. So., Minneapolis, Minn.

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Distributors: Buffalo, Syracuse, Rochester, Pittsburgh, Baltimore, Washington, Hartford, New Haven, Portland, Seattle, San Francisco, Los Angeles, Denver, Salt Lake City.

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INDUSTRIAL REGULATORS
HONEYWELL

Minneapolis-Honeywell Regulator Co., 2715 Fourth Ave. So., Minneapolis, Minn.
☐ Send me pamphlet on Unit Heater and Sectional Control Systems.
☐ Have your representative call. I understand there is no obligation.

Name..... *Position*.....
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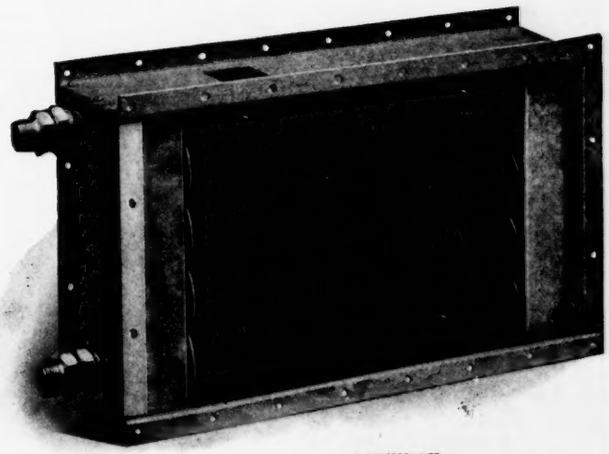
Announcing

ANOTHER PIONEER CONTRIBUTION TO FAN ENGINEERING

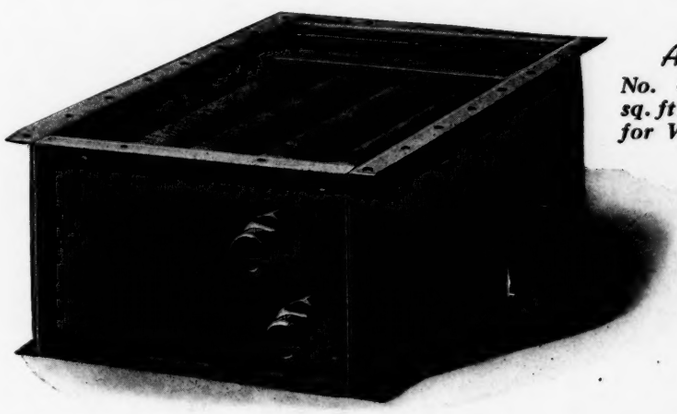


BOOSTER UNITS AEROFIN
No. 600-H, 1.15 sq. ft. Face Area, for Horizontal Air Flow

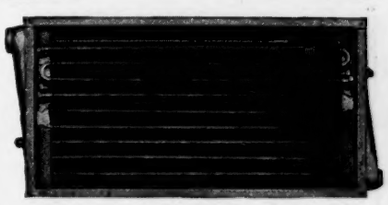
BOOSTER UNITS AEROFIN

For Horizontal or Vertical Air Flow—5 Sizes of each Type
170 to 1430 c.f.m.—350 lbs. working steam pressure

Complete information upon request to Newark



BOOSTER UNITS AEROFIN
No. 600-V, 1.15 sq. ft. Face Area, for Vertical Air Flow



The Standardized Light-Weight Fan System Heat-Surface
4 Types 196 Standard Sizes
Pressures up to 350 lbs. gauge
Section illustrated is UNIVERSAL AEROFIN, 2½ to 200 lbs.

Any Office will gladly render prompt, efficient, technical cooperation

AEROFIN *is sold only by Manufacturers of Nationally Advertised Fan System Apparatus.*
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AEROFIN CORPORATION

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United Artists Building DETROIT
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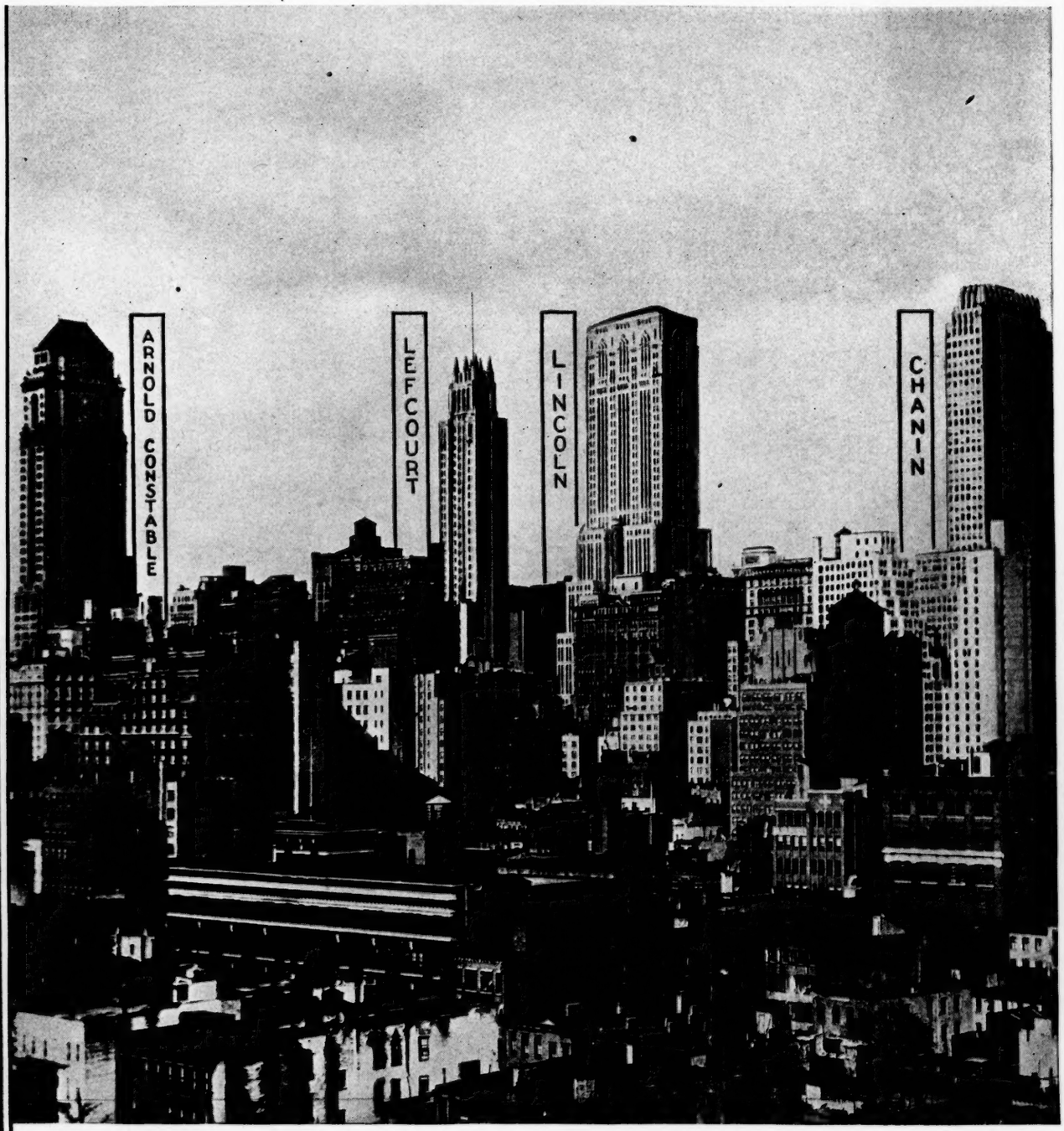
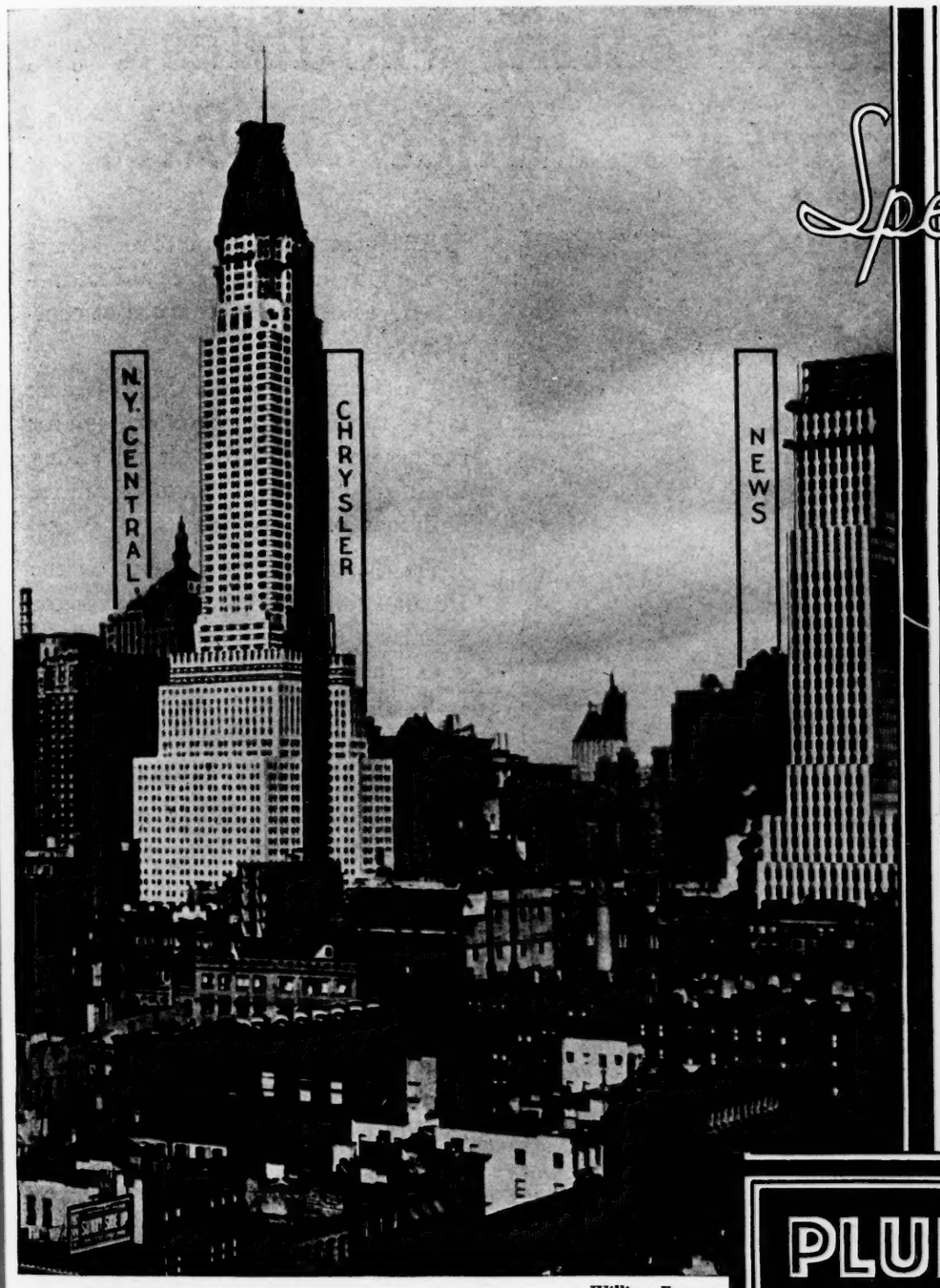


7 Outstanding Walworth installations

All seven of these towering new office buildings are Walworth-equipped. Why? Because the leading architects and contractors know that they can look to Walworth for every requirement of the most up-to-date piping systems that must operate unfailingly and for many years.

In this age of standardization the full line of Walworth products offers an unequaled opportunity for the builder to place unified responsibility on one source of supply.

WALWORTH COMPANY
General Sales Offices: 60 East 42nd St., New York
• DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD •



William Frange

on New York's Sky-line

The Walworth products supplied for these buildings include bronze, iron and steel valves and fittings for heating, plumbing and fire protection.

WALWORTH

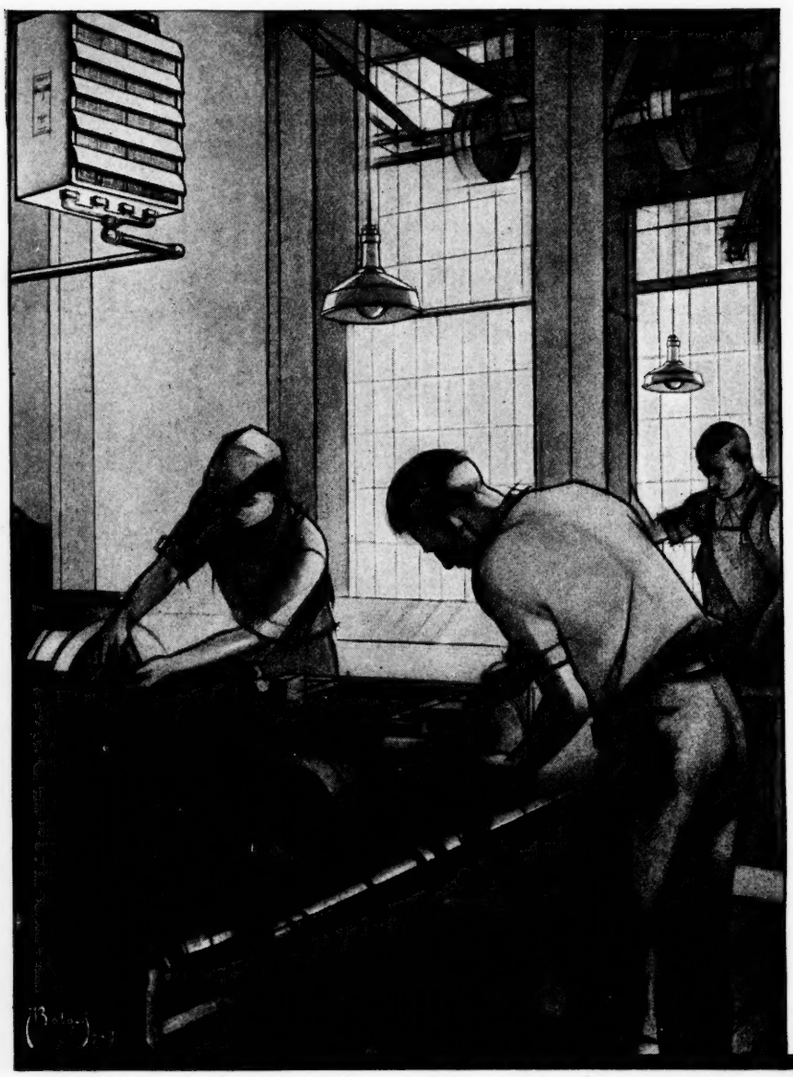
Specify

WALWORTH
VALVES
FITTINGS
AND TOOLS

for

PLUMBING
AND
HEATING

Freedom from heating troubles . . . *customers expect it . . .* hiJet *provides it*



IT'S a great satisfaction to sell a heating job—install it—get paid for it—and never hear a single word of complaint about it.

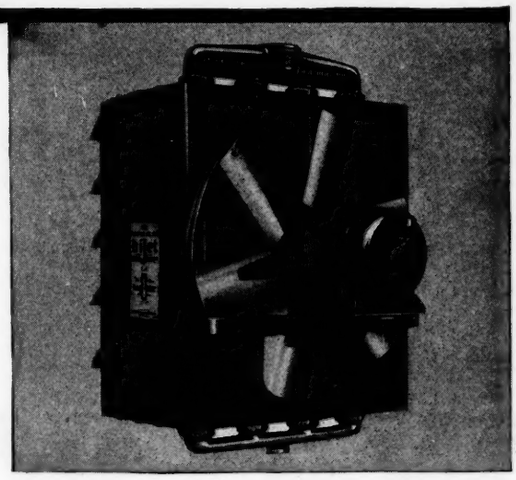
The Herman Nelson hiJet Heater makes such an experience common for the heating contractor. It has a long life of trouble-free, economical service built into it.

The hiJet heating element is the Herman Nelson Wedge Core Radiator which has no brazed, welded, soldered or expanded joints to fail and leak—no parts that can rust or be damaged by expansion and contraction strains. Withstands pressures up to 150 pounds.

In operation, the hiJet directs a vertical jet of warm air downward at high velocity, dispelling the cold air strata at the floor line, and placing heat where heat is needed.

A specially designed motor—the Her-Nel-Co—permits simple speed control with minimum running current. The hiJet comes in three sizes—all easy to install. Write for catalogue.

THE HERMAN NELSON CORPORATION, MOLINE, ILLINOIS



The HERMAN NELSON

hiJet

TRADE MARK

HEATER

For the economical distribution of heat in Factories, Railroad Shops, Roundhouses, Warehouses, Mills, Garages, Gymnasiums, and all industrial buildings, as well as in special process rooms where uniform heat maintenance is required.

BELFAST, ME. BOSTON SPRINGFIELD, MASS. PROVIDENCE, R. I. NEW YORK CITY SYRACUSE

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TORONTO WINNIPEG, MAN. CALGARY LONDON OSLO MELBOURNE TOKIO, OSAKA

PLAIN TALKS ON OIL BURNER PROFITS

No. 3—THIS QUESTION OF "SERVICE"
HOW ELECTROL DEALERS PROTECT THEIR PROFITS

Service is too often the "Hidden Leak" in dealerships which are apparently profitable. But it is a problem which responds to intelligent analysis and control. Read what T. E. Larkin, Treasurer of the Troy Oil Burner Corp., Troy, N. Y., says on this subject:

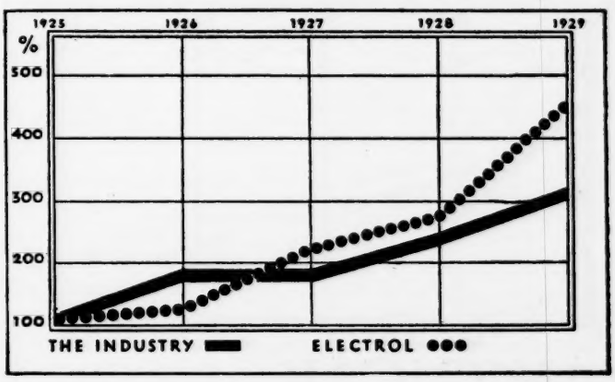
Tom Larkin Covers the Point

"We have learned to judge service requirements in relation to profits. Where do the service dollars go and what do they bring back? Since customer good will is an asset, a portion of this expense is rightfully charged to good will. The legitimate expenses of the service department are rigorously controlled. To keep within the budgeted allowance obviously requires a minimum of emergency calls. The answer is to start right with sound equipment and to fully utilize the cooperative policies of the manufacturer. Electrol has been the answer for us."

Service Not a Problem

Mr. Larkin is right. The Electrol Dealer's Service Department presents no problem. Correct design and fine workmanship in the manufacturing of the product give little need for attention, and insure low costs when adjustments are required.

Time-tested by 12 years of dependable service, backed by an aggressive organization and a carefully developed retail marketing method, Electrol has enabled its dealers to increase their profits year after year.



Growing Faster Than a Fast Growing Industry

Since 1925, the Oil Burner Industry has tripled its growth. In the same period Electrol's growth has been 4¼ times. From 6th place to 3rd in the last three years.

For the Heating Contractor— a Profit Either Way

1. THE ELECTROL FRANCHISE. There's a nice profit in the Electrol Franchise for the Heating Contractor. This is abundantly proved by the success achieved by many leaders in the business.
2. THE ELECTROL COOPERATIVE PLAN. You will find the Electrol dealer in your territory prepared to make an attractive cooperative arrangement. One that adds to your income; safeguards your professional reputation and requires no extra investment. Let us give you details.

Member of the Oil Heating Institute

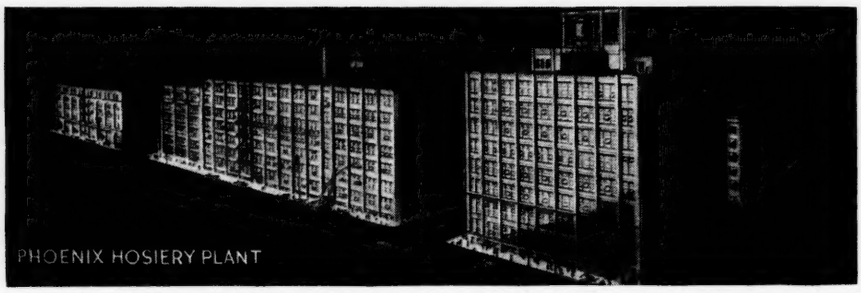
ELECTROL

The* OIL BURNER *with the Master Control

227 East 45th Street, New York City

ELECTROL, INC., H
227 East 45th Street, New York
I would like to know more about—
The Electrol Franchise_____
The Electrol Cooperative Plan_____
Name_____
Address_____
City_____ State_____

HOW FILTERED AIR



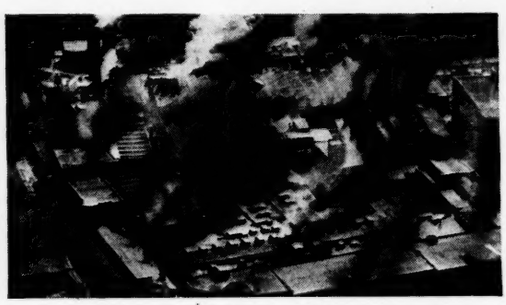
HELPS PHOENIX HOSIERY SOLVE THEIR PROBLEM OF QUALITY-MASS PRODUCTION

WITH growth of plant and production, and the increasing problem of dust, maintenance of high quality in mass production is an acute problem. The Phoenix Hosiery Company, of Milwaukee, has solved the problem through the use of American Air Filters, which are capable of providing their plant with 150,000 cubic feet of clean air a minute. According to a guaranteed survey made by the A. C. Nielsen Company, the cleanliness and improved condition of the packaged product have been reflected in increased sales. Maintenance costs have been reduced. Employee health and efficiency have increased.

AMERICAN AIR FILTERS

COMBINING THE PRODUCTS FORMERLY MANUFACTURED UNDER THE FOLLOWING TRADE MARKS:

NATIONAL AIR FILTERS TRADE MARK
Reed Air TRADE MARK filters ALL METAL
MIDWEST TRADE MARK



Important Industries and Buildings Users in Every City

Air filters protect products, employees and plants; banks and valuables in bank vaults; schools, school equipment and school children; stores, merchandise, customers and good will in the leading industries and buildings in every city. Air filters are just as necessary to your interests as they are to these. AMERICAN AIR FILTER COMPANY, *Incorporated,* Louisville, Ky.

Free Literature
Get our free books on air filters in uses in which you are interested. Mail the coupon today. No obligation.

American Air Filter Company, *Incorporated,*
113 Central Ave., Louisville, Ky
Please send literature regarding the application of modern air filters. Use in which interested _____
Name _____
Street _____
City _____ State _____

The Syracuse Memorial Hospital where a scientific system of air filtration assures cleanliness.

Filtered Air Particularly Important To Hospitals

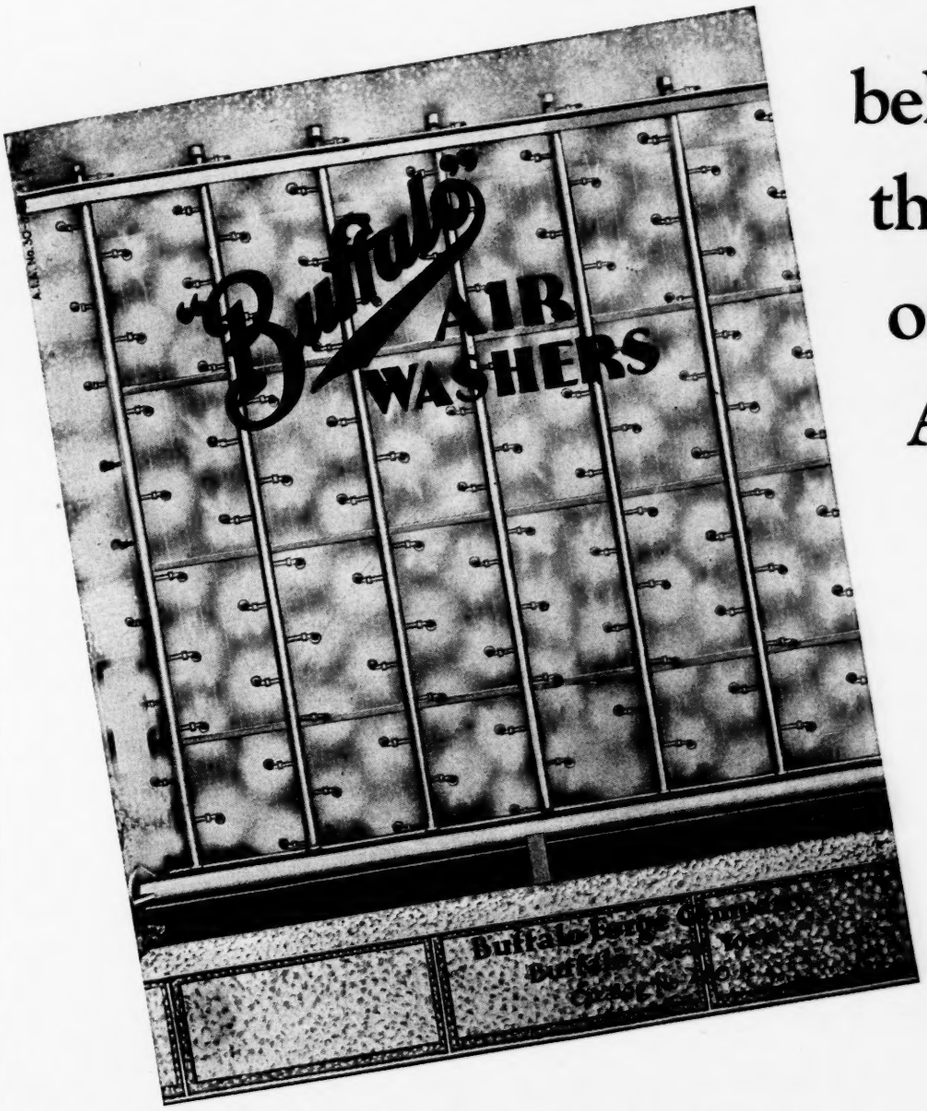
The great majority of industrial plants and commercial institutions are equipped with air filtration systems. There are very practical reasons for this. The clean, pure air assured by filters simplifies the problem of maintaining high quality in mass production. Also, the level of employee health and efficiency is higher in plants where the air is clean and pure. Hospitals have even more vital need of air filtration.

Nowhere, of course, is dust-free, bacteria-free air as important as in a hospital. Consider, for instance, the necessity for the highest possible point of cleanliness and sanitation in operating rooms. Fine equipment and delicate instruments must be scrupulously guarded. Through the actual process of the operation, the patient must be protected from the slightest possibility of infection. Only by scientifically controlled purification of air can hospital authorities know their patients are at all times and under all conditions protected from the contamination of street dust and bacteria.

The Syracuse Memorial Hospital, Syracuse, New York, shown above is one of many modern hospitals insuring a constant flow of clean, pure air by means of air filtering.

The savings in cleaning and redecorating costs in hospitals using filtered air are notable. In hospitals where there is no control of dust-laden air, much more labor is required for dusting and washing furniture, fixtures and equipment. In addition, walls must be cleaned and painted more often.

This New Book



belongs in the files of every Architect, Engineer and Contractor

A request on your letterhead will bring this catalog, No. 480-A, by return mail.

A new illustrated catalog, dealing with the latest developments in air conditioning equipment as used in modern structures, has just been completed by our engineers.

If you are interested in conditioned air, from silent and economical apparatus, we suggest that you write for your copy immediately.

Write for Your Copy Today

Buffalo Forge Company
459 Broadway, Buffalo, N. Y.
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"Buffalo"

AIR WASHERS AND HUMIDIFIERS

Chicago is ILLINOIS minded

Flying over Chicago's famous loop district, the airman's camera registers a view that includes eight of Chicago's newest and most magnificent structures; monuments to Chicago's progress—and, to the standing of ILLINOIS Heating Systems—for they are all ILLINOIS equipped.

Selected from among ILLINOIS installations within one year, in Chicago alone, these buildings typify the widely varying conditions, and exacting operative requirements that are being met, to the entire satisfaction of architects, engineers, contractors, owners.

When millions of dollars are invested in projects such as these, it is done carefully; wisely. ILLINOIS, is specified for the heating, for client satisfaction must be assured.

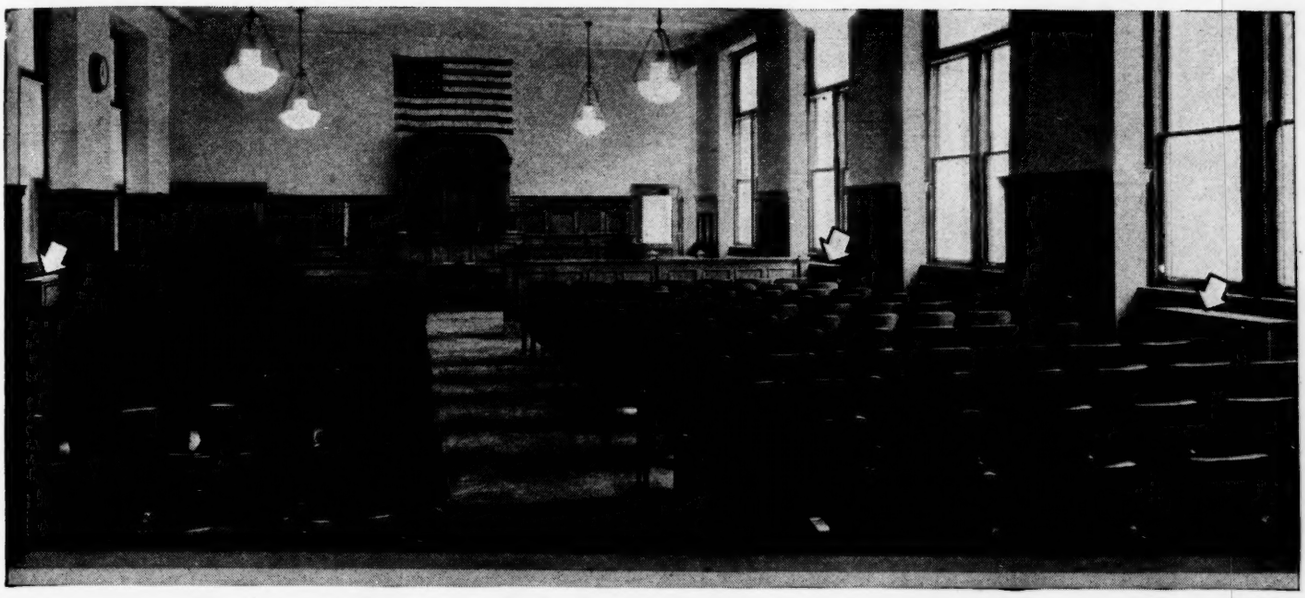
Write for Bulletin 22

ILLINOIS ENGINEERING COMPANY
ROBT. L. GIFFORD. PRES. INCORPORATED 1900
BRANCHES AND REPRESENTATIVES IN 40 CITIES
CHICAGO

1. Merchandise Mart
   "The World's Largest Building"
   Marshall Field & Co., Owners
   Graham, Anderson, Probst & White, Architects
   Robert Gordon, Inc., Heating Contractors
2. The Chicago Daily News Building
   Holabird & Root, Architects
   J. A. Sutherland, Engineer
   Robert Gordon, Inc., Heating Contractors
3. Steuben Club
   K. M. Vitzthum & Co., Inc., Architects
   E. B. Kaiser, Heating Contractors
   E. S. Volk, Engineer
4. The Foreman National Bank Building
   Graham, Anderson, Probst & White, Architects
   Phillips Getschow Co., Heating Contractors
5. *One La Salle Street
   K. M. Vitzthum & Co., Inc., Architects
   John D. Small, Engineer
   Mehring & Hanson Co., Heating Contractors
6. Willoughby Tower
   S. N. Crowen & Associates, Inc., Architects
   Kohlbry-Howlett Co., Heating Contractors
   A. W. Nelson, Engineer
7. Board of Trade
   Holabird & Root, Architects
   J. A. Sutherland, Engineer
   Mehring & Hanson Co., Heating Contractors
8. *Buckingham Building
   Holabird & Root, Architects
   J. A. Sutherland, Engineer
   Kohlbry-Howlett Co., Heating Contractors

*Illinois Zone Control Systems.

Photo by Chicago Aerial Survey



CLEAR THE COURT!

OF DEAD AIR, DRAFTS, DUST AND NOISE FROM THE STREET!

Courtrooms that are stuffy, dusty and drafty, work a hardship on both bench and bar. Where so much depends on clear heads, the air should be clean... and invigorating!

Just step into this modern courtroom. Here the air is always refreshing, always at the right temperature. Windows are closed...there are no drafts, no noise and dust from the street. Proceedings are not hampered by the depressing effects of bad air.

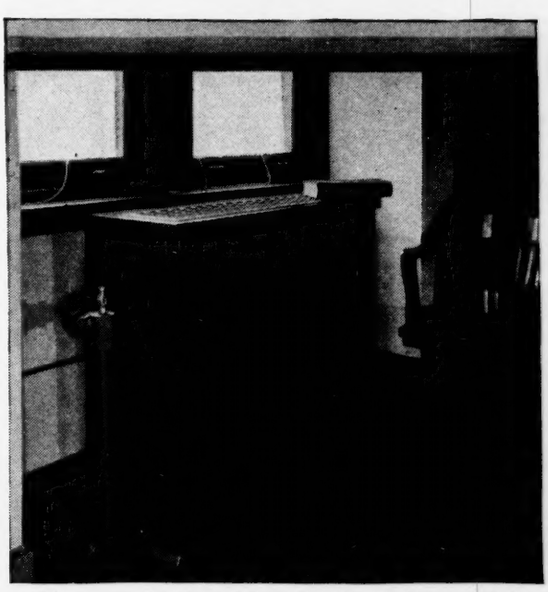
There are 17 Sturtevant Unit Heater-Ventilators in the courtrooms, libraries, and complaint rooms. These units bring in outdoor air, filter it, temper it...then pass it gently into the rooms. They are quiet, automatic, and finished to blend in with the rich oak woodwork.

Sturtevant Unit Heater-Ventilators are adaptable to a wide variety of installations in schools, churches, institutions, office buildings, etc. You will be interested in our Catalog 361...and it will be a pleasure to send you a copy.

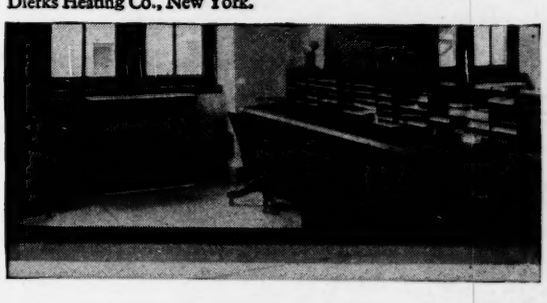
B. F. STURTEVANT COMPANY

Main Offices: HYDE PARK, BOSTON, MASS. ✎ CHICAGO ILL., 410 No. Michigan Ave., ✎ SAN FRANCISCO, CAL., 681 Market St.

Branch Offices in Principal Cities. Canadian Offices at: Toronto, Montreal and Galt. Canadian Representatives: Kipp Kelly, Ltd., Winnipeg. Agents in Principal Foreign Countries.



Above, a corner of a library; *below,* the traffic complaint room, in the Washington Heights Court House, New York City; *Architect:* George M. McCable, New York; *Engineer:* J. P. Whiskeman, New York; *General Contractor.* Jas. McWilliam, Inc., New York; *Heating Contractor:* Dierks Heating Co., New York.

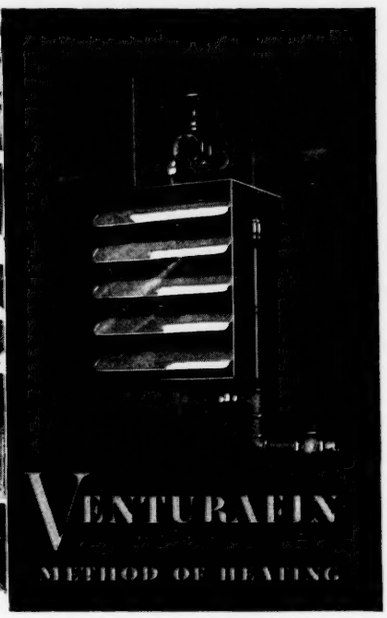


Sturtevant Unit Heater-Ventilator

Reg. U. S. Pat. Off.

SUPPLIES OUTDOOR AIR ∾ FILTERED CLEAN ∾ AND TEMPERED

HEAT
WITH UNIT HEATERS



Venturafin Units can be mounted on wall, column or ceiling with ordinary ¾-inch hanger pipes.

HEAT CONTROL

. . . is vital to Heating Economy

No wasteful heating of ceiling areas first, no overheating one part of the building and chilling another —Venturafin Unit Heaters force *heated* air *where* you want it, *when* you want it and *as much* as you want. They maintain an even temperature throughout the building—not too hot, not too cold.

The benefits of the Venturafin Method of Heating are many and far-reaching. As a result of eliminating drafts, cold corners and heat pockets, workers are more comfortable and working conditions become more pleasant. Absences due to colds, headaches and similar ailments are sure to be greatly reduced. The quality of the work is sure to be improved, and all-around efficiency increased.

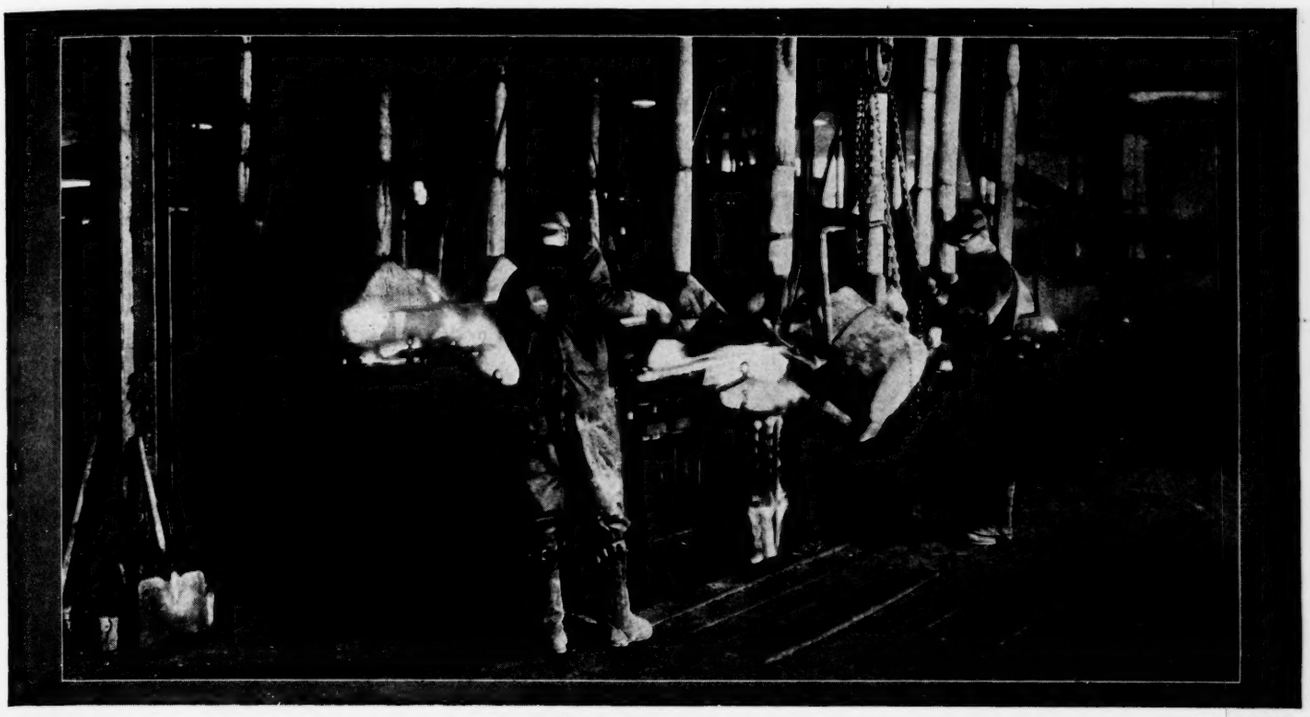
Venturafin Units for Industrials are equipped with a three-speed heat control switch.

Forced heat, at any desired velocity, directed in one or several directions simultaneously, is made possible by Venturafin's three-speed heat control switch and individually adjustable streamline air-jet deflectors. Venturafin Units are easy to install and can be used on high, medium or low pressure steam applications.

Venturafin Units are in demand everywhere. They are backed by sound and extensive national and trade magazine advertising as well as by a special merchandising program. Our story on how you can build up a mighty profitable Venturafin business without increasing your overhead is sure to be of interest to you. Write for details today. (1035)

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

American Blower
Sirocco
VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881



ARCO CAST IRON SEAMLESS PIPE IS CAST VERTICALLY

REGULARLY FURNISHED IN 12 FT. LENGTHS

Hand Cutting Arco Metal Pipe

Hand Threading Arco Metal Pipe

The illustration above shows how Arco Metal Pipe is cast vertically. The molten iron is poured into the mold at the top end of the pipe. This method of casting insures a perfectly round seamless tube, of uniform wall thickness and true outside diameter.

Cast Iron Pipe has lasted for hundreds of years because of its dense corrosion-resisting skin. Arco Cast Iron Seamless Pipe has the same dense texture throughout its entire wall thickness, as the skin of ordinary cast iron pipe. It is just as resistant to rusting at the bottom of its thread as at any point on its surface.

Arco Metal Pipe is carried in stock and distributed by jobbers of plumbing, heating and mill supplies.

AMERICAN RADIATOR COMPANY

ARCO METAL PIPE DIVISION

40 West 40th Street, New York
816 So. Michigan Avenue, Chicago

1344 Broadway, Detroit
8th and Broadway, Cincinnati

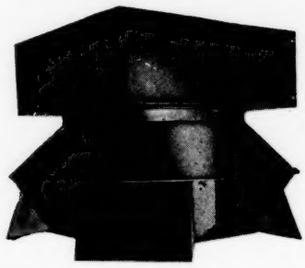
1294 East 55th Street, Cleveland
4201 Duncan Avenue, St. Louis

WING FEATHERWEIGHT

Easy to Adapt to Special Requirements of Any Type of Building—

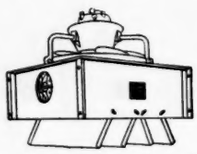
WING Featherweight Unit Heaters simplify the work of laying out completely successful heating systems for industrial buildings and garages. No matter what the size, shape and construction of a building it is easy to install and adjust Wing Featherweight Unit Heaters so that every part of it will be adequately heated with minimum outlay and with an exceptionally low fuel cost.

Type LC Unit with Regular 4-way Discharge



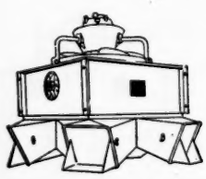
Wing Featherweight Type LC Unit with motor and fan beneath heating element, requiring minimum clearance to ceiling. Also used with fresh air duct.

TYPE HC UNIT

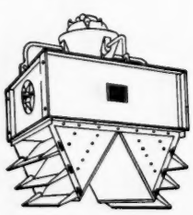


Type HC Unit, with Vane Discharge No. 1. Motor and fan above heating element.

Moderate height, square areas.



Type HC with Discharge No. 5 Low positions—square areas.



Low—Long narrow areas.

The reasons for Wing adaptability are:

1. Wing Featherweight Unit Heaters are so light that they can be placed anywhere overhead with any type of roof construction. Each heater can be placed just where it will be most effective. They are not dependent on pillars, girders, side walls or partitions for support.
2. Wing Featherweight Unit Heaters discharge vertically downward, distributing heated air in all required directions. Fewer units are required because they are centrally located in regard to the area heated.
3. Wing Featherweight Unit Heaters can be placed as high as necessary to clear cranes and other equipment. Their powerful fans can deliver air to the working level from any height.

   They should be placed right up under the roof or ceiling to prevent waste due to the banking up of hot air overhead.
4. Wing Featherweight Unit Heaters are made in the two types shown. Type H C has a number of specially designed discharges which distribute the warmed air evenly over different shaped areas from high, low or medium heights. All Wing discharges are equipped with adjustable diffusers.

   Heating Engineers will find many advantages to themselves and their customers in using Wing Featherweight Unit Heaters. Write us for detailed information showing the methods of installation.

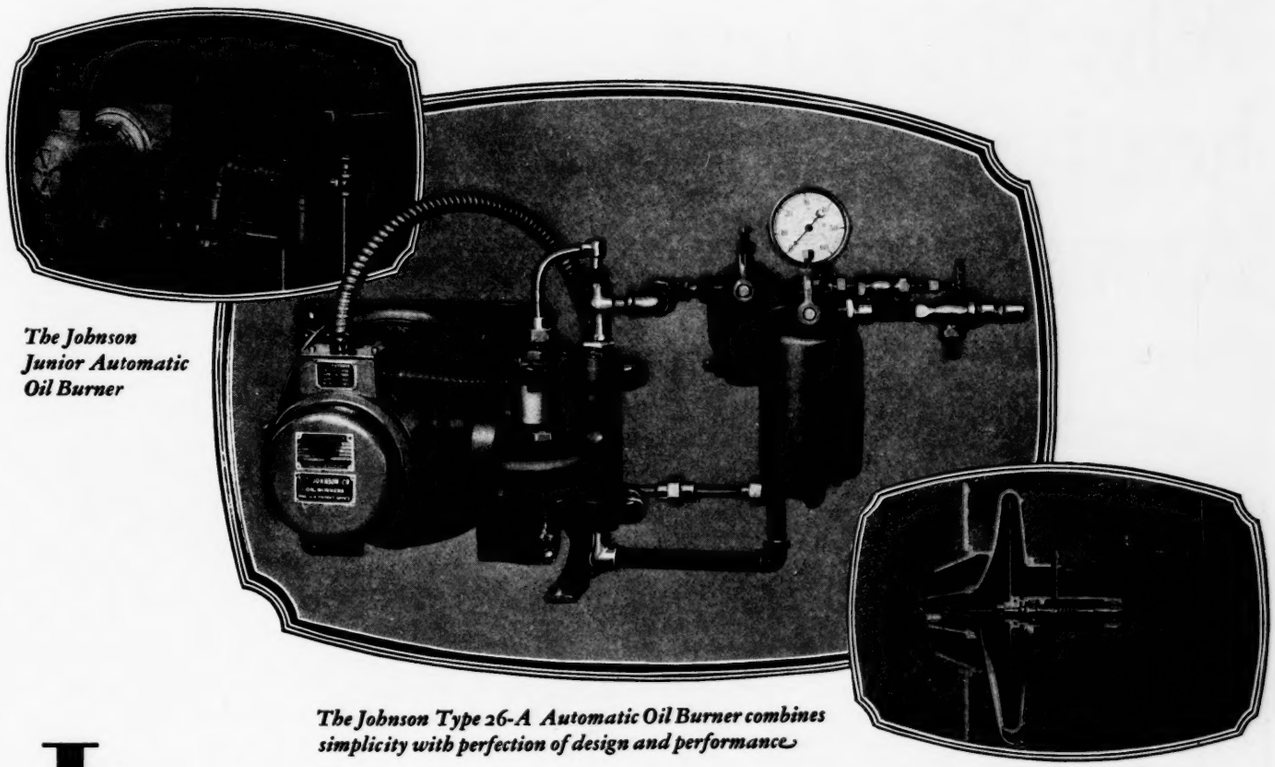
L. J. WING MFG. CO.

Manufacturers of Wing-Scruplex Propeller Fans and Exhausters, Wing Featherweight Unit Heaters, Wing-Scruplex Fog Eliminators, Wing Turbine and Centrifugal Turbine Blowers, and Wing Steam Turbines.

Dept. 7, 158 W. 14th Street, New York, N. Y.

"Heat with Unit Heaters"

UNIT HEATERS



The Johnson Junior Automatic Oil Burner

The Johnson Type 26-A Automatic Oil Burner combines simplicity with perfection of design and performance

Is there really a problem in Specifying an OIL BURNER?

LAST YEAR 142,000 new oil burners were installed. Those selected on the basis of manufacturer and dealer responsibility are proving their worth with the regularity of the automobile.

In specifying or using any product, you check the standing of the maker, the reliability of the representative. The same tests assure oil burner satisfaction. Why, then, is there any problem?

Behind every Johnson burner lies 25 years of experience in the installation and exclusive manufacture of oil burner equipment. This experience, plus a complete line of oil burner equipment*manufactured, means that the S. T. Johnson Co. has solved, and can solve your every heating and power problem. Scores of thousands of Johnson Burners are supplying owners from Maine to California, and in many foreign lands, with dependable, economical, convenient heat.

An Engineering Service is maintained for you, for heating and ventilating specialists, for anyone with heating problems. The accumulated data of over a quarter of a century is at your disposal.

* * *

We will also be pleased to send you a copy of our catalogue as published in "Sweet's" for your files. Just write "Bulletin 4-B please," on your letterhead or business card, no obligation incurred, and your copy will be sent without delay.

JOHNSON OIL BURNERS

Listed as Standard by the Underwriters Laboratories

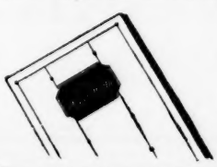
Manufactured and Guaranteed by

S. T. JOHNSON CO.

Executive Office and Factory: 940-950 Arlington Street, Oakland, California
Factory Branches: San Francisco, Sacramento, Stockton, Calif.; Philadelphia, Pa.

Member Oil Heating Institute

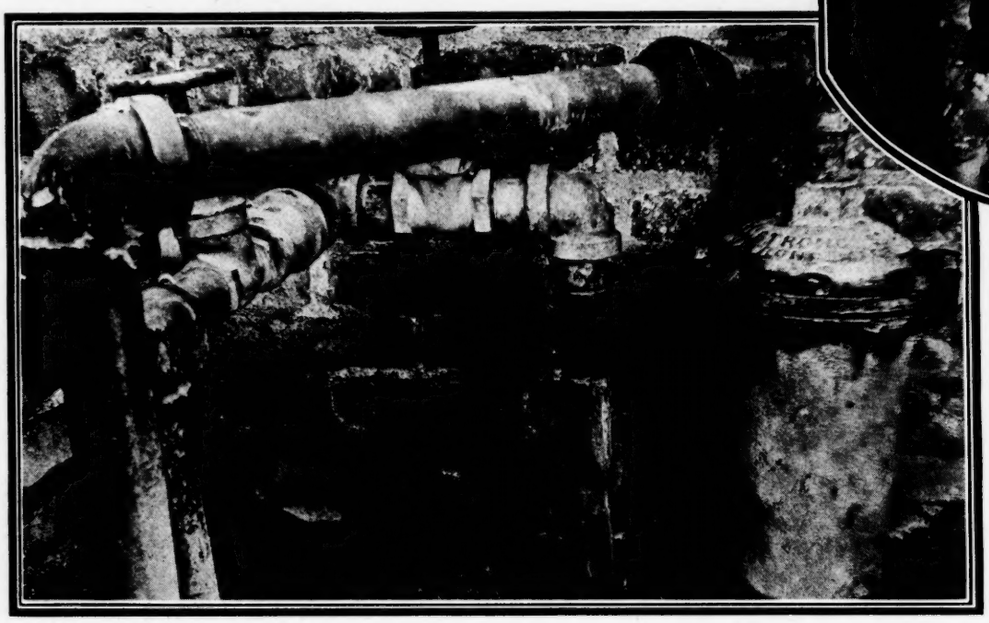
AN OPPORTUNITY... *for MEN of Vision and Ability...*



PROFITS in the oil burner business are limited by the market for the burner you represent. There is a Johnson Burner for every heating and power purpose... Rotary Burners in three styles, seven sizes, with either semi or full automatic control. While Natural Draft, Whirlwind, Low Pressure Air and Steam Atomizing Oil Burners, electric and steam driven oil pumping and preheating equipment fill in the gaps... blanket the market. The Johnson dealer enjoys the advantages of selling a burner that will not be "orphaned"... he will be given the fullest factory co-operation in developing his territory. Send for our new free book, "TODAY'S OPPORTUNITY." It tells why the Johnson franchise offers greater dealer profits. This coupon will bring your copy without delay. Mail it now, stating territory desired.

Name _____ *Address* _____

Why this large heating system uses Armstrong Traps



THE illustrations show one of the 91 Armstrong inverted bucket traps used to drain the steam heating mains of the Indianapolis Power and Light Co. This is a very large low pressure system with a total connected load of approximately 2,500,000 sq. ft. of radiation.

Armstrongs are favored by this and other central heating systems because of their extreme dependability, small size, and large capacity. They operate for years with no attention whatever. Such "foolproofness" is the result of Armstrong impossibility of airbinding; non-clogging from scum or sediment; and no wire-drawing (the Armstrong has heat treated special chrome steel valves). As the picture shows, they are compact enough to be supported by connecting pipes.

The efficient operation of unit heaters is also insured by Armstrong traps, the effectiveness of which is attested by the fact that there are more of them in service than any other mechanically operated trap. We are glad to assist heating engineers in determining the proper size of traps for heating jobs.

No. 2 Armstrong Trap

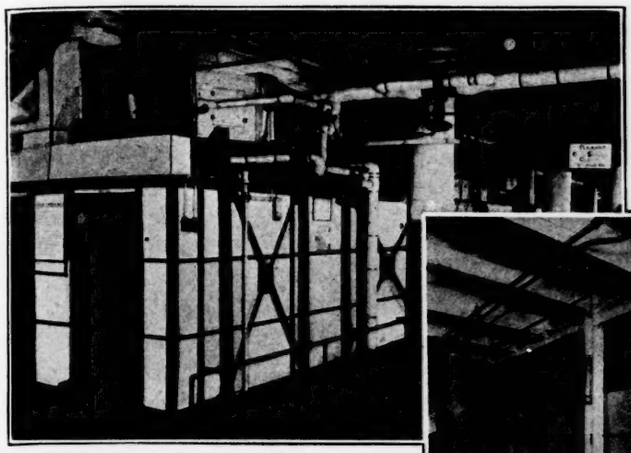
No. 30 Armstrong Trap

ARMSTRONG MACHINE WORKS

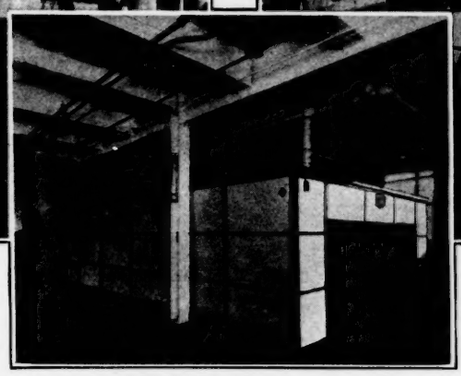
THREE RIVERS, MICHIGAN

District Representatives in 42 Cities

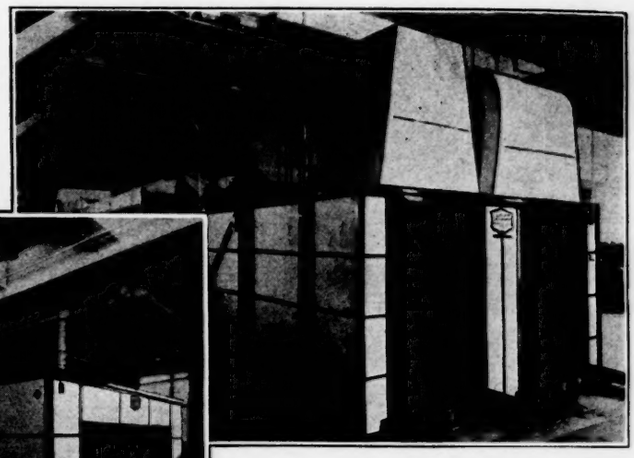
H&V7-Gray



Showing the "Insulite built" Dryer of I. Miller & Sons, Inc., Shoe Manufacturers, Long Island City, N.Y.



A view of the Drying Room of The Ideal Shoe Company, Milwaukee, Wisconsin.



A front view of the Dry-System shoe dryer of the Endicott-Johnson Company, Endicott, N. Y.

INSULITE
the Wood-Fiber Insulating Board

A Superior Insulation For Drying Systems

IF you want to know the merits of an insulation material—try building a Drying Room. That's the supreme test.

First, the material must be efficient,—for fast drying heat must be confined and maintained at all times.

And the material must also be moisture resistant, —for the supersaturated atmosphere will quickly ruin its insulation efficiency. You must also use a structurally strong material, able to stand up day after day, year in and year out, under the hammering and banging of racks.

Insulite is one material that combines all these properties.

Consider the efficiency of Insulite. It has an insulating value of .30 to .32 B. T. U. per square foot, per hour, per inch thickness, per degree Fahrenheit. And, remember, in Insulite —full half inch thick—this means 12½% more insulation than you get in ordinary 7/16 inch insulating boards.

Furthermore, Insulite, made from the tough fibers of northern woods, is chemically treated to resist moisture, and is not subject to rot or disintegration. In a recent strength test of four well known insulating boards, Insulite proved to be 14% stronger.

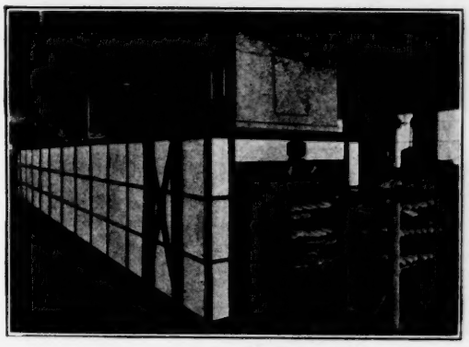
Insulite has many uses in the heating, ventilating, and air conditioning field. As roof insulation, air duct lining, or wherever temperature must be maintained and controlled, it is a superior material.

THE INSULITE CO.

{A Backus-Brooks Industry}

1200 Builders Exchange, Dept. 29G, Minneapolis, Minn.

OFFICES IN ALL PRINCIPAL CITIES



The 44-foot straight through conveyor Dryer of the Johansen Brothers Shoe Co., St. Louis, Missouri.

ENGINEERING SERVICE

Our Engineering Department is at your service, without obligation on your part, and will gladly assist you with any insulation problem. May we send you additional information about Insulite, and also samples. Write today, or just fill out and mail the coupon.

MAIL THIS COUPON

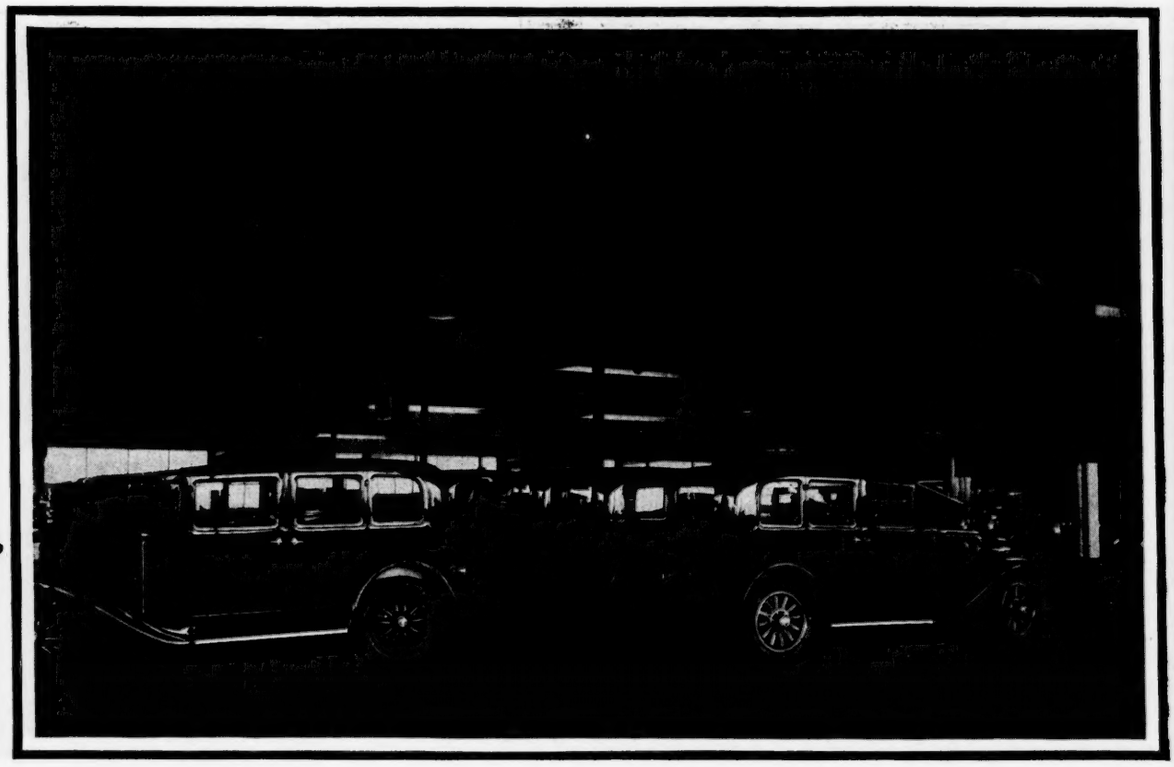
THE INSULITE CO.
{A Backus-Brooks Industry}
1200 Builders Exchange, Dept. 29G
Minneapolis, Minnesota

Gentlemen: Please send me Insulite literature of interest to Heating, Ventilating and Air Conditioning Engineers; also sample of Insulite.

Name.....

Address.....

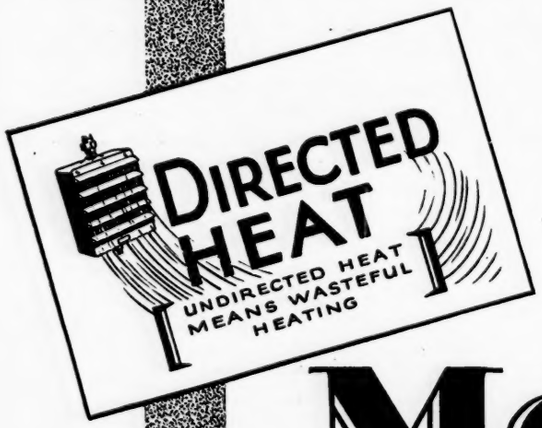
City..... *State*.....



TIGHT TO THE WALL

-No Space Waste with Modine

YOU save valuable space with Modines—they suspend from the steam line—up, out of the way . . . Whether it's auto storage as above, the placing of machinery and benches or the arranging of any equipment, Modines permit better utilization of any industrial building . . . But space is not all you save. There are fuel costs, maintenance costs and trouble—you save every one. To be sure, Modines cost a bit more than many other similar units, but the fact that there are 30,000 of them in operation proves that price is no criterion of economy . . . Let us study your particular requirements and submit recommendations. A line brings our consulting service to you.



MODINE MANUFACTURING COMPANY
707 RACINE STREET RACINE, WISCONSIN
Manufacturers of Unit Heaters — Domestic Copper Radiation—Automotive Radiators.
London Office: S. G. Leach & Co. Ltd., 26-30 Artillery Lane

Modine Unit HEATER

A MODINE Product

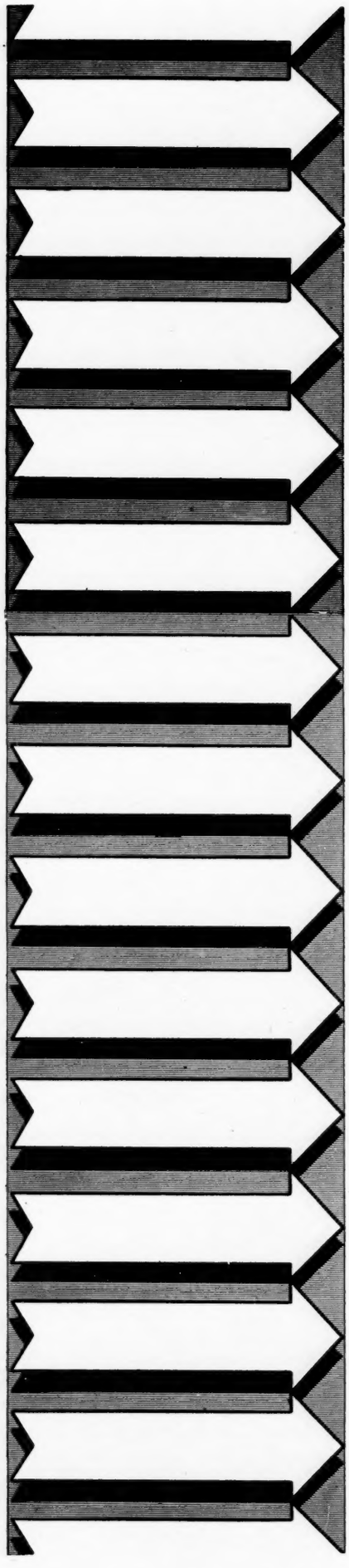
FOR STEAM, VAPOR, VACUUM, HOT WATER HEATING SYSTEMS

© 1930 Modine Mfg. Co.

JOHNSON Control in the Palmolive Building is on the direct radiation for the entire 12th, 13th, 14th, 34th, 35th, 36th and 37th floors: and miscellaneous individual offices throughout the building. All of the ventilation for the building is also Johnson Controlled. Thus the importance of automatic control is again expressed, and the leadership of The Johnson System again confirmed.

JOHNSON SERVICE COMPANY, MILWAUKEE, WISCONSIN . *Established 1885* . Branches in all Principal Cities. Interesting Johnson catalog sent on request.

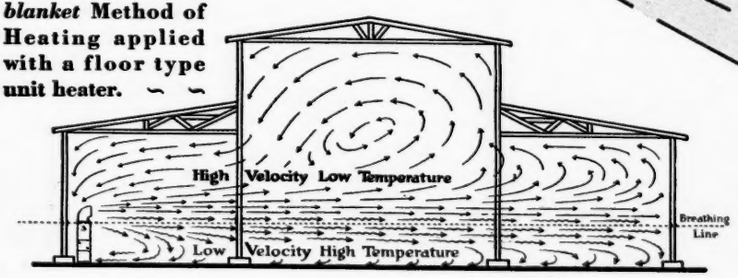
JOHNSON HEAT & HUMIDITY CONTROL



Announcing AIR *method*

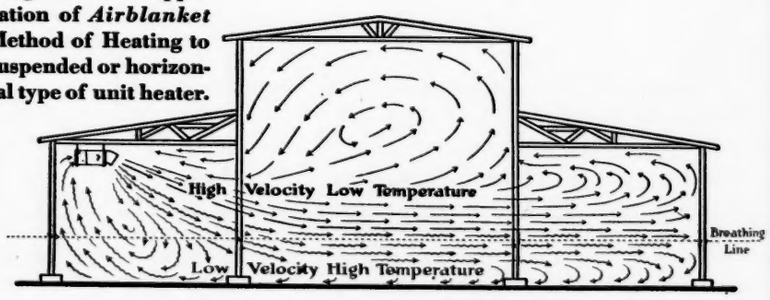
FLOOR TYPE

Diagram shows *Airblanket* Method of Heating applied with a floor type unit heater.



HORIZONTAL TYPE

Diagram shows application of *Airblanket* Method of Heating to suspended or horizontal type of unit heater.



THE GREATEST HEATING

the new Skinner BLANKET *of industrial heating*

THIRTY years ago Skinner Bros. originated and introduced the unit method of heating industrial and other large dimensioned buildings. Unit heating was rapidly adopted because of its outstanding superiority over methods then in use, and since that time has found almost universal acceptance.

Today Skinner Bros. offer another great contribution to industrial heating and ventilating—a method that will mean new comfort, new efficiency and new savings wherever it is installed—the *Airblanket* Method of Heating. The results obtained from this new method during the past three years in trial installations under the most trying conditions are amazing.

This remarkable new principle—the *Airblanket* Method of Heating—can be described briefly as a method in which a blanket or ceiling of low temperature moving air is projected horizontally over the breathing zone of a building to hold the warm air issuing from a unit heater down in the breathing zone. The warmed air, held down in this way, is then able to give up its valuable heat units to the working zone without the usual loss of heat.

It has been estimated that in certain types of industrial buildings as much as 85% of the total cost of heating is incurred by heat losses that occur above the breathing zone. Since the *Airblanket* Method of Heating does away with the necessity of first filling the space above the working zone with warmth, the advantages of this new method, from the standpoint of economy alone, are worthy of your careful investigation.

For complete information on Skinner Bros. *Airblanket* Method of Heating, clip and mail the coupon today for your copy of the booklet entitled: "Controlling Heat and Heating Cost with the *Airblanket*."

AIRBLANKET
TRADE MARK

SEND COUPON FOR FREE BOOKLET

*Name*_____

*Address*_____

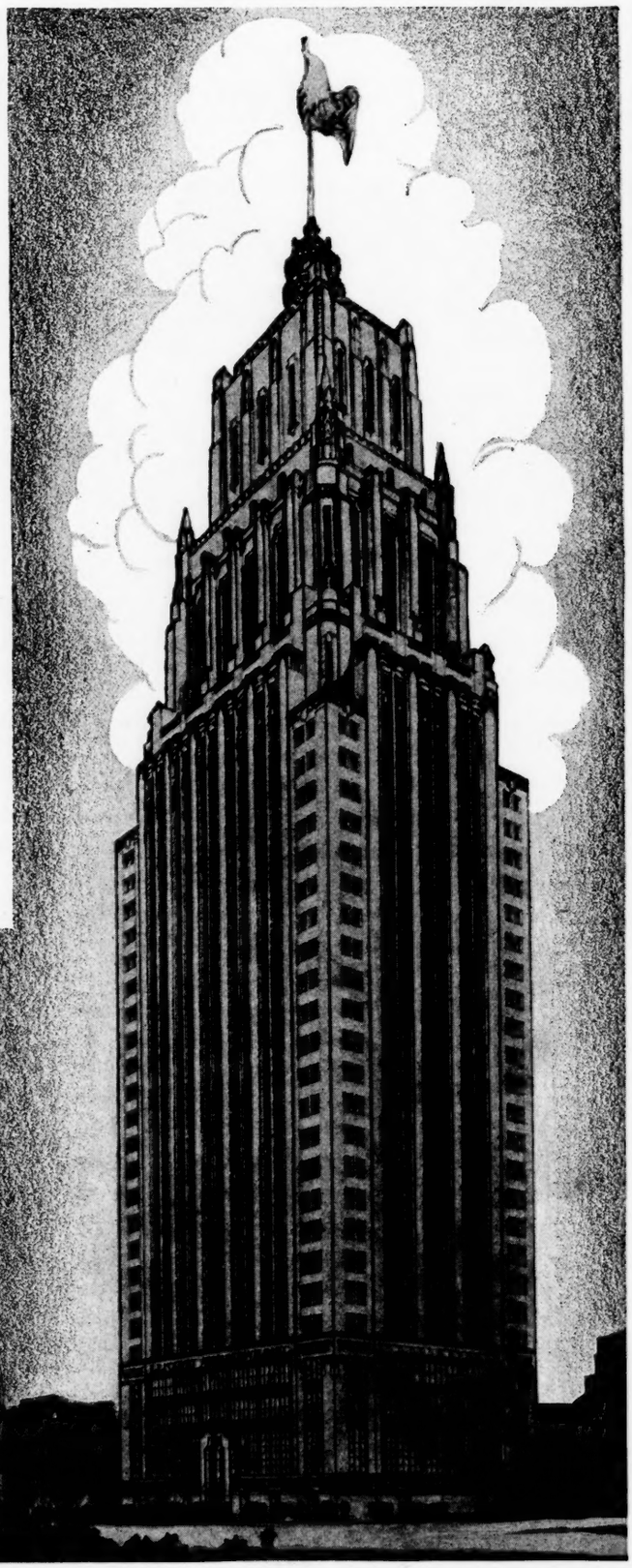
*City*_____ *State*_____

SKINNER BROS. MFG. CO., INC.
1402 S. Vandeventer Avenue St. Louis, U. S. A.
Branches in All Principal Cities
"The Originators of Unit Heating" H&V-7

IMPROVEMENT IN THIRTY YEARS

NEW JERSEY'S TALLEST

LEFCOURT-NEWARK BUILDING, NEWARK, N. J.
Architect: Frank Grad, Newark, N. J.
Engineer: Eadie, Freund & Campbell, New York City
Plumbing Contractor: Jaehnig & Peoples, Newark, N. J.
Heating Contractor: Schrenell Bros., Newark, N. J.



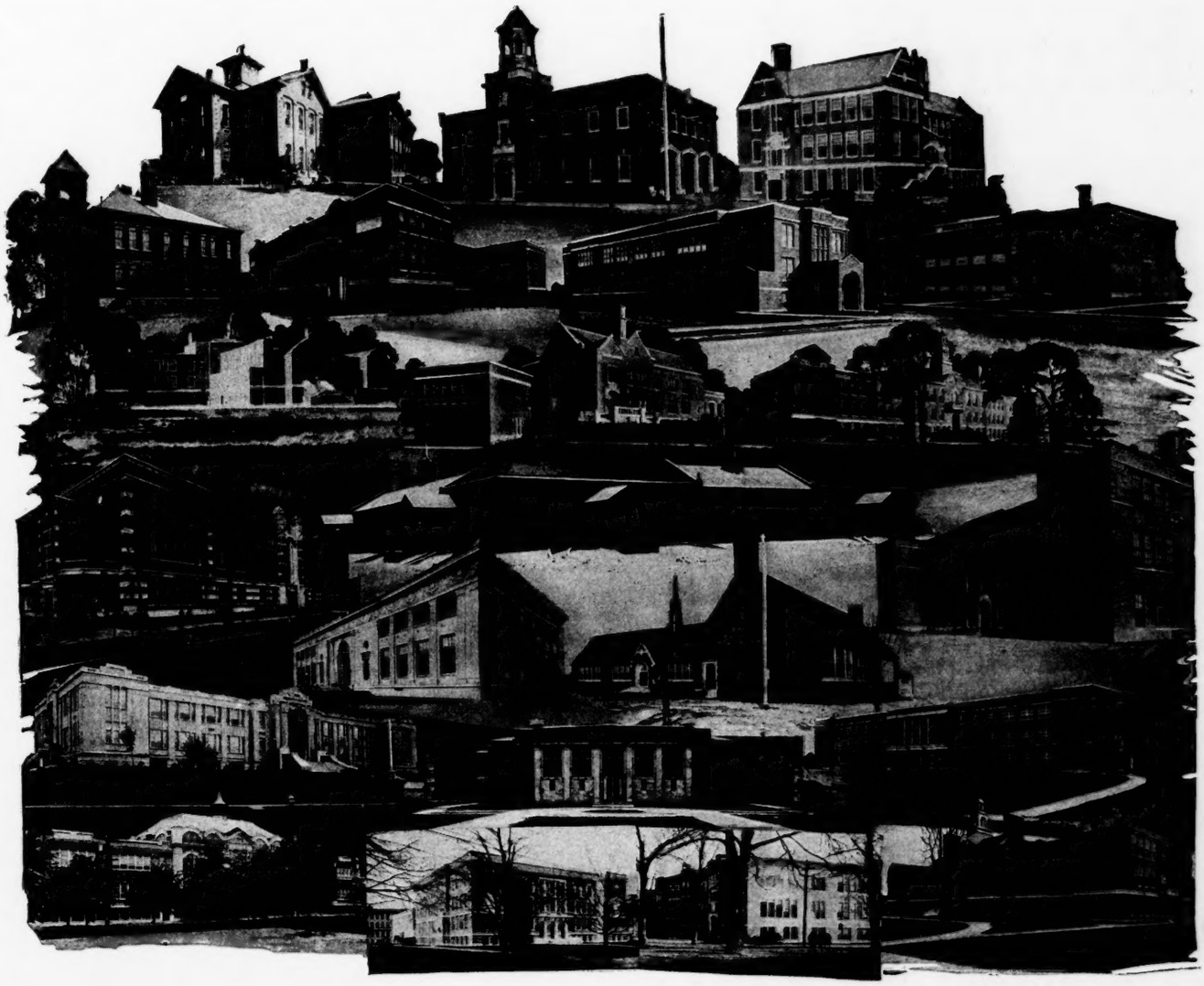
Unusually effective in interior plan with its commanding and graceful exterior lines, this recently completed building ranks with some of the finest in the land, a structure of which New Jersey may well feel proud. Thirty-seven stories from street to tower—the highest building in the State of New Jersey—the Lefcourt-Newark Building is the latest addition to Newark's skyline. Naturally the architects and engineers, experienced in specifying for some of America's finest buildings, turned to time-tested and quality-proven material.

Thus, as in many previous instances, they chose NATIONAL for the major pipe tonnage. In addition to NATIONAL Pipe for the heating, soil and waste lines, they specified NATIONAL Copper-Steel Pipe for the vent lines and rain leaders as an additional protection against atmospheric corrosion. Many years of experience and numerous service tests have proven that copper-steel pipe gives added life to those lines exposed to alternate wet and dry conditions. Write for Bulletin No. 11, describing—

NATIONAL COPPER-STEEL PIPE
The Original Copper-Steel Pipe

NATIONAL TUBE COMPANY—Pittsburgh, Pa.
Subsidiary of United States Steel Corporation

NATIONAL PIPE



Thousands of schools are equipped with PeerVents

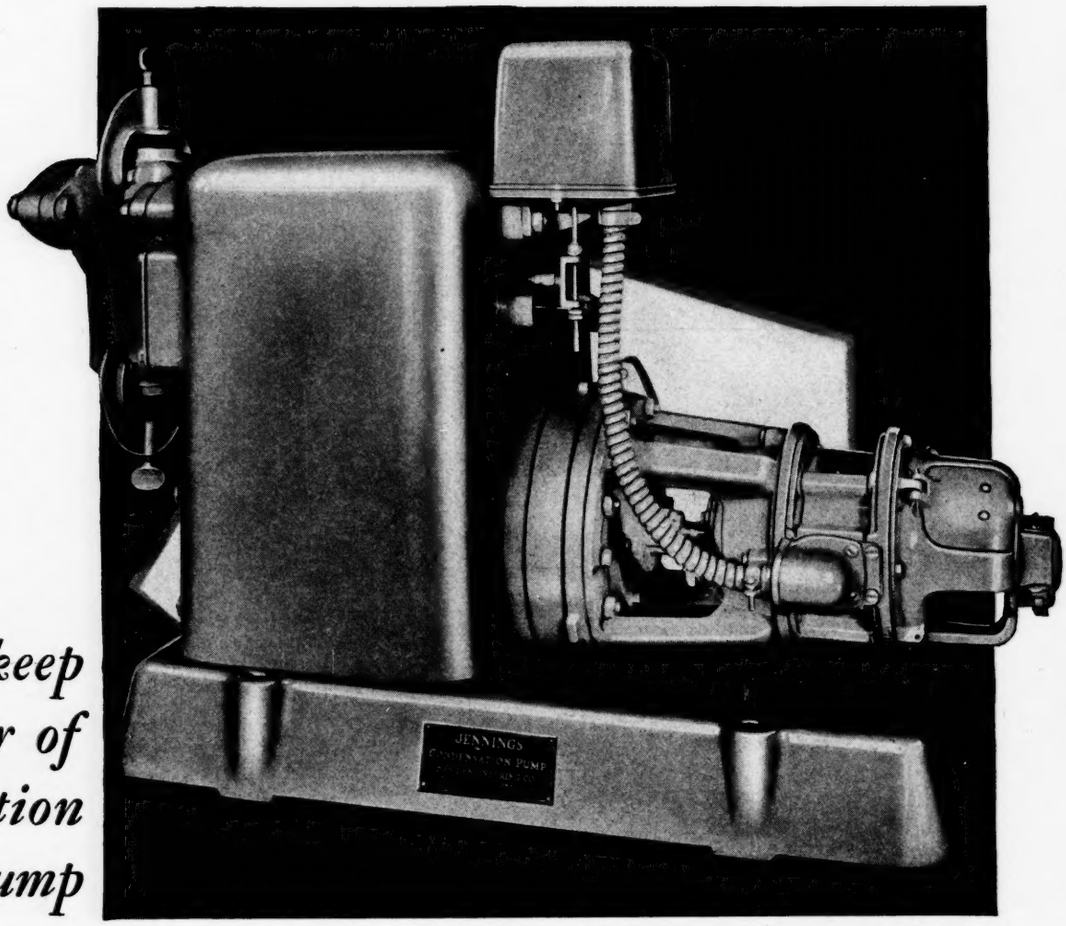
SINCE the original PeerVent Heating and Ventilating Unit was designed and installed 19 years ago, thousands of buildings in towns and cities from coast to coast have been equipped with PeerVents. These PeerVents of nineteen years ago are still giving perfect satisfaction.

With this background, is it any wonder that numerous repeat orders for PeerVents are constantly coming in from users? Such repeat orders are proof of satisfactory and efficient service. The PeerVent of today is backed by forty years of specialized experience in heating and ventilation.

Investigate the new PeerVent.

PEERLESS UNIT VENTILATION CO., Inc.
BRIDGEPORT, CONNECTICUT
Pioneers in Unit Ventilation
Resident Engineers in Principal Cities from Coast to Coast

RADIATORS *below boiler water line?*



. . . keep them clear of condensation with this pump

IN laying out a gravity two-pipe steam heating system, it is not always possible to return condensation to the boiler by gravity. Radiators must often be set below boiler water line. Under such conditions efficient operation of basement radiators can be assured by the installation of a Jennings Condensation Pump.

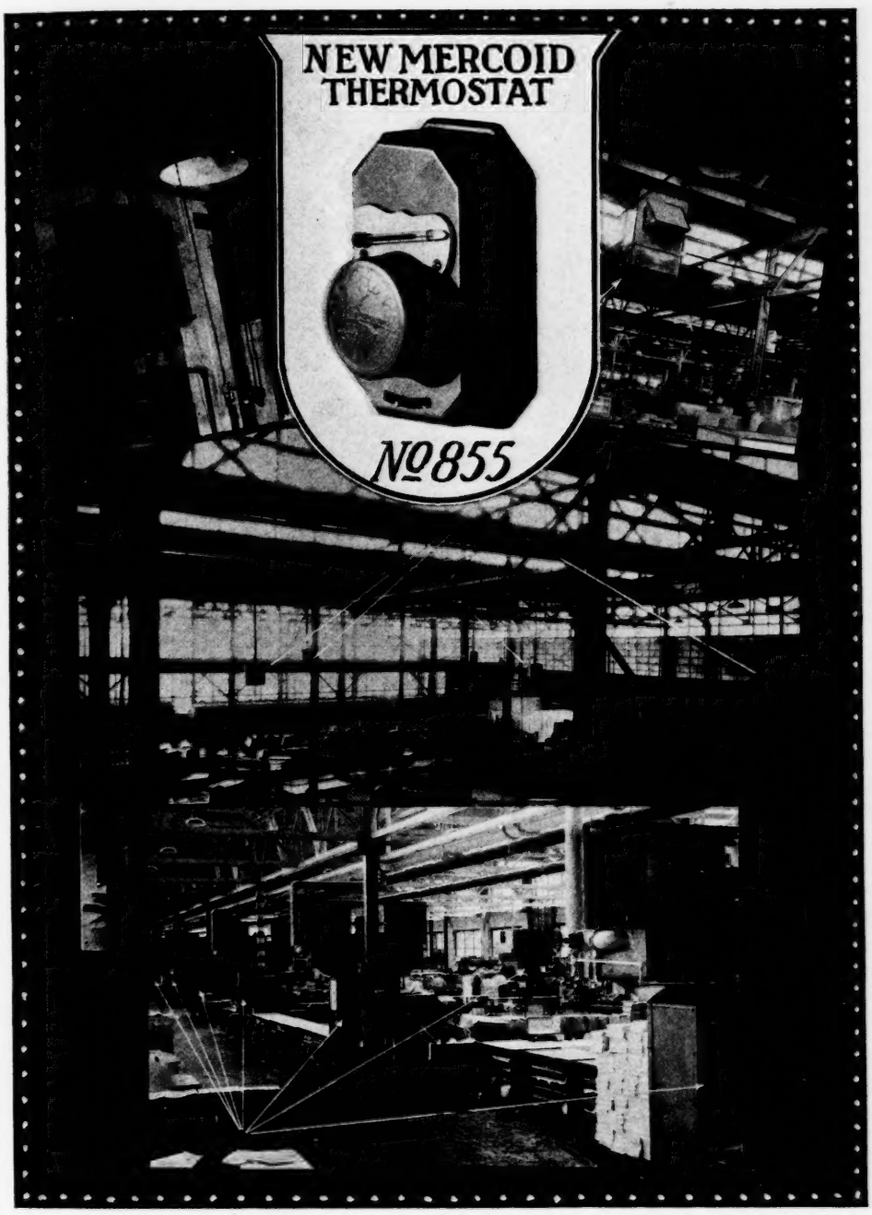
A Jennings Condensation Pump is simply and sturdily constructed. Receiving tank, pump working parts and driving motor are built into a single compact assembly. The centrifugal impeller is mounted on a short extension of the motor shaft. There is only one stuffing box. Automatically controlled, the pump requires little attention. The rectangular form of the complete unit permits installation in a corner against the wall. *Write for Bulletin 99.*

NASH ENGINEERING CO.
81 Wilson Road, So. Norwalk, Conn.

Jennings Condensation Pumps are furnished in capacities of 4 to 200 g. p. m. of water for serving up to 150,000 sq. ft. equivalent direct radiation.

Jennings Pumps

Mercoid Controls Make Unit Heaters More Efficient



Several unit heater installations using Mercoid Controls

The Mercoid Thermostat is the leading control for unit heater application. The new model has many desirable features.

It is dependable, accurate and has a record for its unfailing performance.

RANGES

56° to 80° F. and 38° to 60° F. Approximate normal operating differential less than 2 degrees

Complete Catalog Sent Upon Request

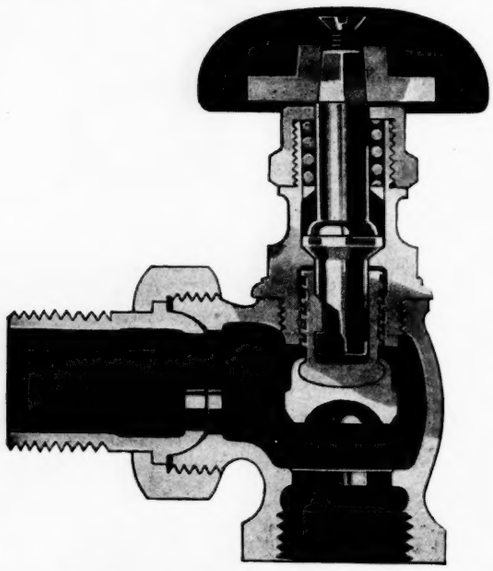
THE MERCOID CORPORATION

4201 BELMONT AVENUE, CHICAGO, ILLINOIS

25 Church St., New York 1129 Folsom St., San Francisco

MERCOID CONTROLS

Marsh Re-enforced PACKLESS WATER Radiator Valves



Oval Wheel
or
Lock Shield

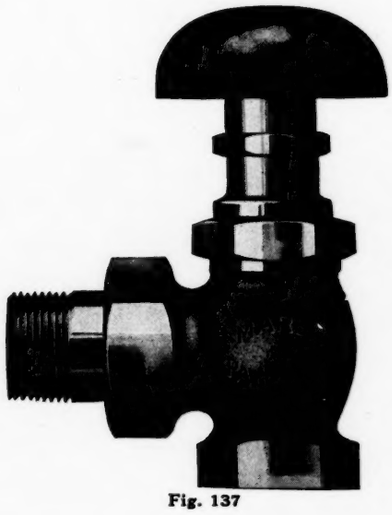


Fig. 137

These valves are quick opening, full pipe capacity, and are GUARANTEED NOT TO STICK AT ANY TIME, OR LEAK AT ANY PRESSURE that a cast iron boiler and radiation will stand.

We believe they are the only Packless valves which will hold high pressure forced circulation and also protect against taking in of air around stem in a sealed system, *two very necessary requirements* for satisfactory service and cost no more than the cheap competition valves. Get our prices.

Marsh Re-enforced GRADUATED WATER Radiator Valves

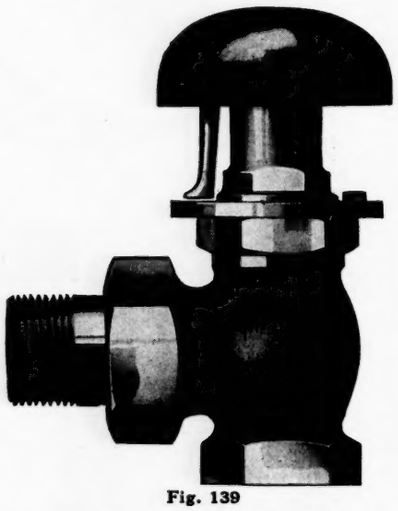


Fig. 139

Oval Wheel,
Lever Handle
or
Lock Shield

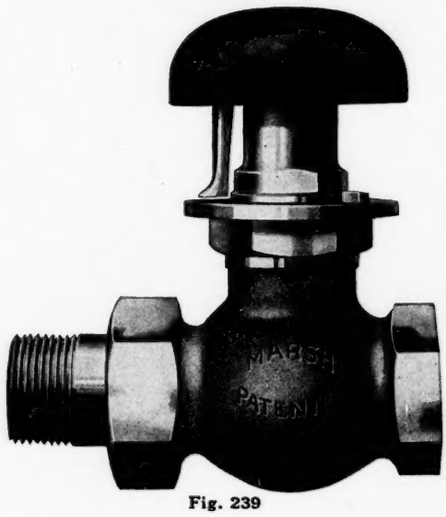


Fig. 239

With these GRADUATED Valves we regulate water heat temperature THROUGH VALVE, the same as for a vapor or vacuum steam system through a Modulating Valve. These are not only of material value for residence service, but we have tens of thousands in use for high pressure service in schools, hospitals and public buildings.

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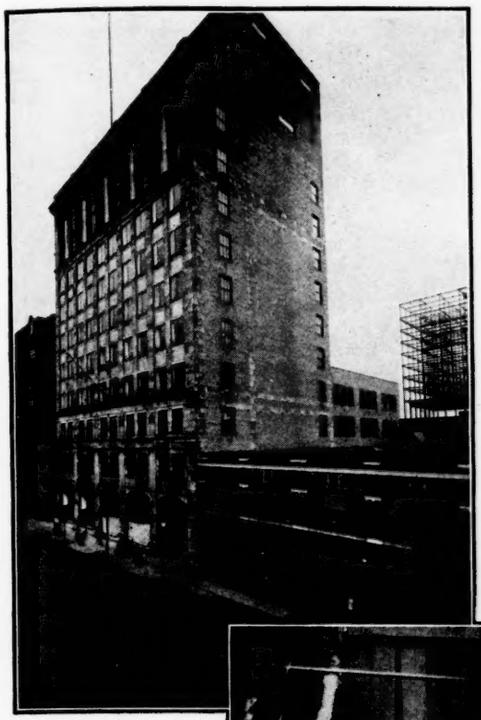

Rochester Gas and Electric Corporation

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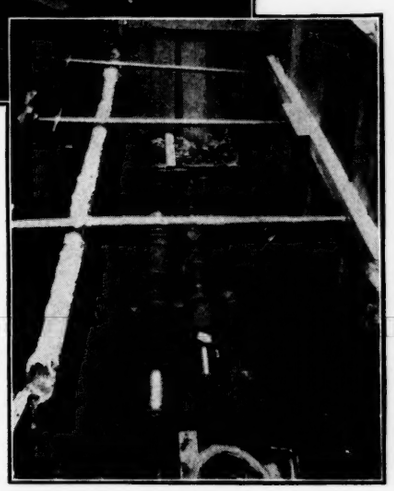
YOU can't make a mistake by following the example of the nation's largest steam producers... district heating utilities whose profits depend on the distribution of steam with minimum loss and maximum freedom from maintenance. The fact that over 90% of the steam utilities in America specify ADSCO pipe line equipment should be ample proof that this equipment can be used to advantage on all of your important steam line installations.



Above: View of the downtown building of the Rochester Gas & Electric Corp., whose district heating service is widely used in the business district of Rochester, N. Y.

At Right: Photo shows 10" steam main and 4" return line in this power company's steam system. Adsco Semi-Guided and Duplex Sleeve expansion joints can be seen in the foreground.

Rochester Gas & Electric Corporation is only one of the scores of constantly expanding steam utilities which use ADSCO Equipment on successive pipe line extensions. Some of their mains have been buried beneath streets and sidewalks for years, without requiring any attention or maintenance. Their profitable experience with ADSCO specialties should point the way to anyone who wants the same degree of efficiency and freedom from repairs.

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NORTH TONAWANDA, N.Y.
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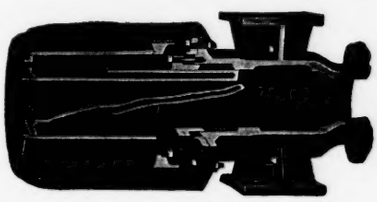

Adsco Duplex-Sleeve Guided Expansion Joint, for pressures up to 400 lbs. and temperatures up to 750 degrees F. Air-cooled sleeve keeps packing cool, prevents deterioration and maintains tight joints.

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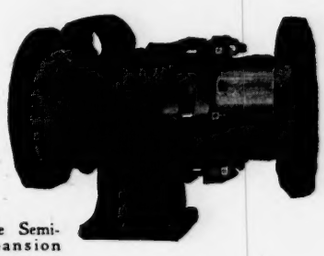
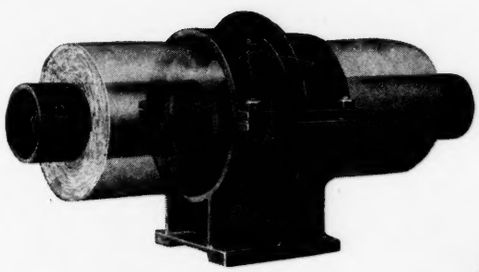
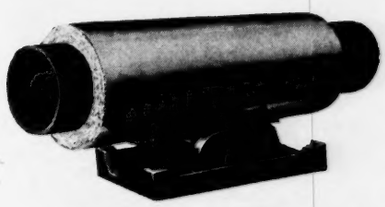


Adsco Single Semi-guided Expansion Joint. For pressures up to 250 lbs. 4, 6, 8, 10, and 12 inch traverse.



Adsco Alignment Guide is designed to act as a support for high pressure steam lines, and to keep them in perfect alignment while expansion is taking place.



Adsco Roller Guides and Saddle Plates support pipe and permit free movement in expansion and contraction. Also allow complete insulation.

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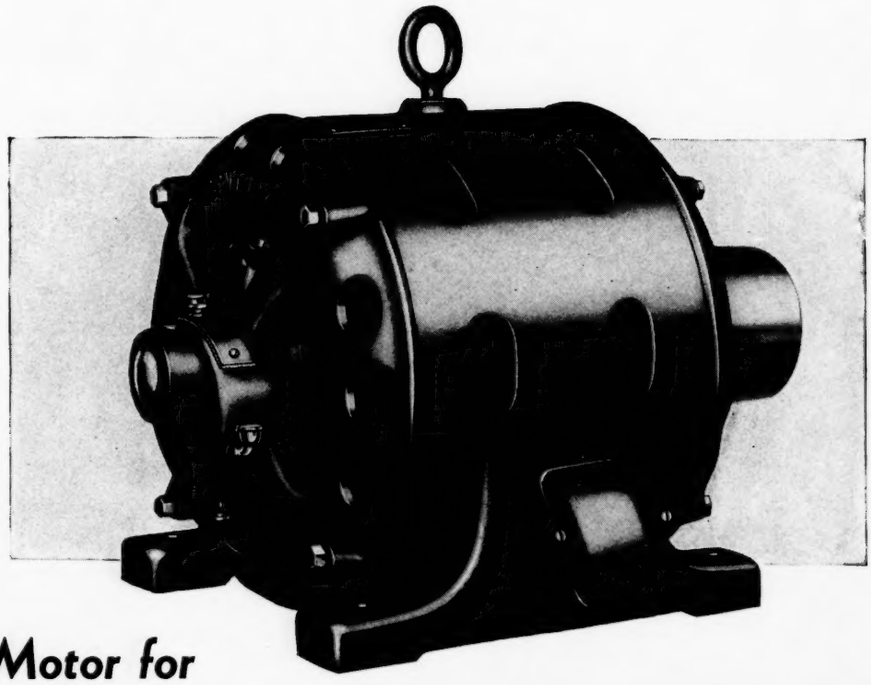

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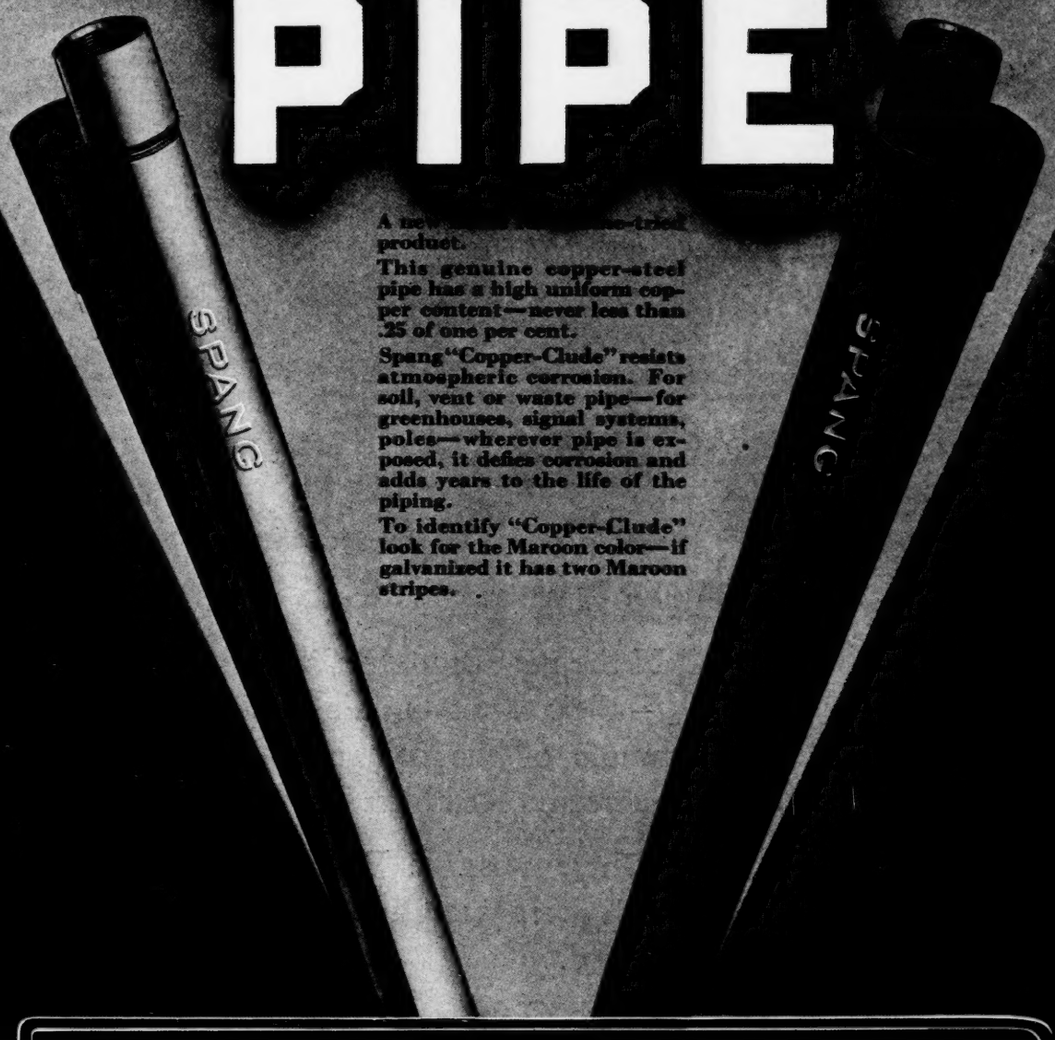

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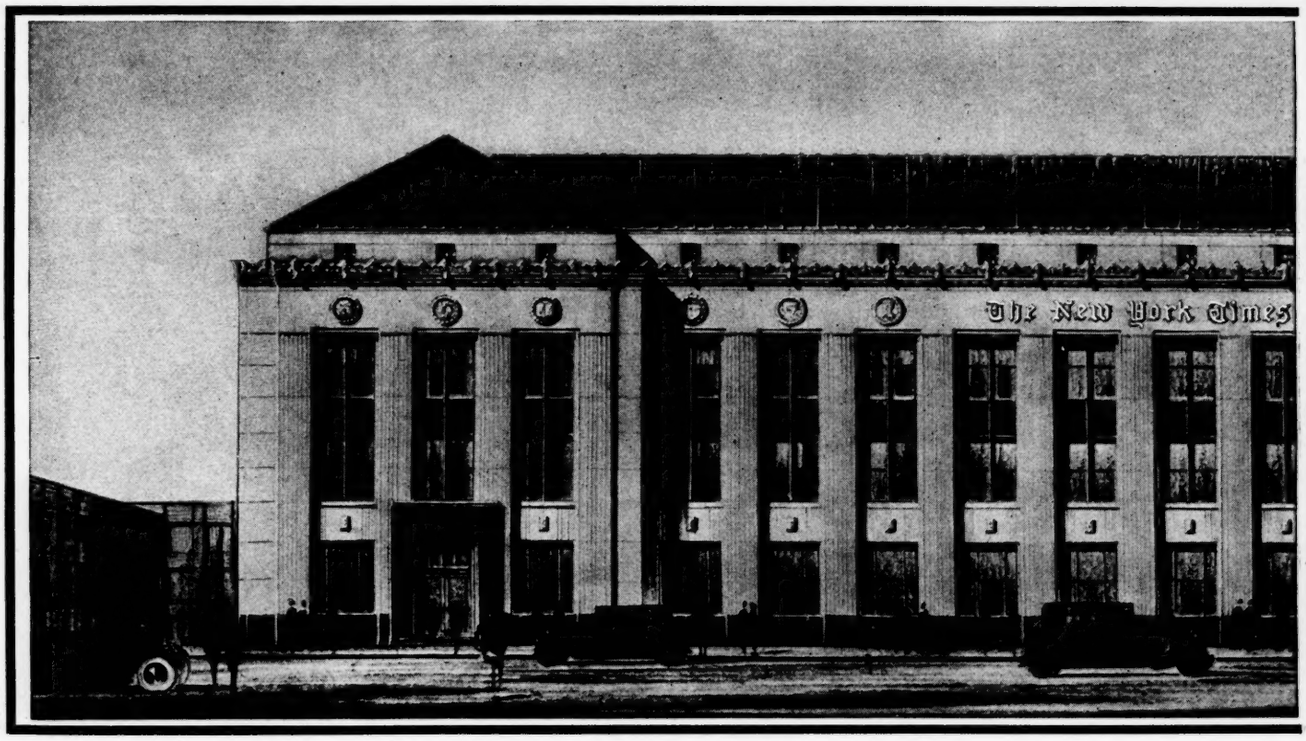
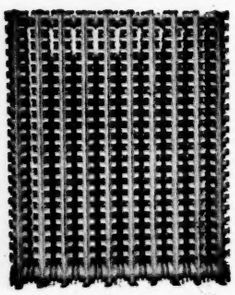


VENTO and

CAST IRON HEATERS



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Where possible Vento was installed, but where the lighter weight seemed desirable Arcoblast was used.

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ENCASED HEATERS

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HEATING AND VENTILATING

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Contents of previous issues of HEATING AND VENTILATING *can be found by consulting the Industrial Arts Index at the nearest library.*

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Future Issues

"HERE are my next three issues," chuckled an editor friend, one day, as he turned in his chair and patted three bundles of manuscript carefully filed away in his copy drawer. I have never forgotten the shock he gave me. For a moment his statement aroused a feeling of envy. Then I remembered that half the zest of publishing is in realizing that future issues, like those of a newspaper, are to be thought of as just so much blank paper, ready to be molded into the finished product. For in the technical publishing field, no less than in strictly newspaper work, there is all the spirit of the chase in the discovery and presentation of "the latest" in the way of engineering news. Nothing so delights the heart of the editor as the "breaking" of a good "story" just in time to catch the last form.

That is why most editors, as a rule, cannot tell their readers, even two months in advance, what they have in store for them.

A. S. Armagnac

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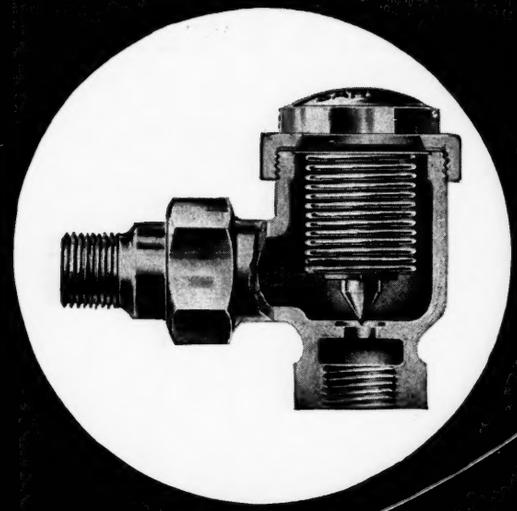

WHY architects and contractors are so exceedingly careful in buying

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HEATING AND VENTILATING

Editorial

FROM the moment the White House Conference on Child Health and Protection was announced last spring, curiosity has been rife as to the place school heating and ventilation would have in its program and what source of information the conference would rely upon for its guidance in this matter. At the time HEATING AND VENTILATING put in its plea, in the form of a telegram to the President, for "qualified consulting engineers to serve on this important committee" on the ground that failure to include such representatives of the heating and ventilating profession would prevent child health and protection from being fully served.

Now that the full scope of the conference has been announced it appears that the section which is "charged," as the government expresses it, with "the School Plant—Its Construction, Equipment and Maintenance" is none other than Thomas D. Wood, M. D., professor of Health Education at Teachers' College, Columbia University, New York, co-outhor of "Ventilation and Health" and probably as uncompromising a champion of open-window ventilation as could be found in a month of Sundays. He is the man, for instance, who said in his book that "men outside the engineering field are chiefly responsible for the advance in the science of ventilation."

In November next the White House Conference on Child Health and Protection will hold its first general meeting in Washington. If heating and ventilating engineers were wrought up over the open-window bulletin issued by the U. S. Public Health Service last fall, what action will they consider appropriate in the face of this challenge to their reputation and authority?

TO the practical heating contractors there is nothing incongruous in endorsing, in the same breath, both the A.S.H.V.E. Boiler Rating Code and the rating code of the Steel Heating Boiler Institute. Since the H. & P.C.N.A. was the originator of the output idea as a basis of rating boilers it is natural for its boiler output committee to say:

"We believe that the A.S.H.V.E., in deciding that complete performance data on each boiler were desirable, have arrived at the only logical conclusion. Such information is not only very helpful to the heating engineer, but to the manufacturer himself. Whether or not the boiler manufacturer will carry out these recommendations remains to be seen. We hope he will, as it is our original idea. However, it is going to be a long and expensive operation for the manufacturer."

There, of course, is the rub. For, as a matter of fact, the A.S.H.V.E. Boiler Code has set an immense task before the manufacturers to secure the required performance data.

Referring, in the same report, to the Steel Heating Boiler Code, which, as every one knows, is based upon physical dimensions, the committee makes this significant comment:

"The Steel Heating Boiler Institute has adopted a definite code for rating steel heating boilers based on physical dimensions. Such a code may be justified by the similarity in design and general characteristics of all steel heating boilers. Their standard ratings are based on design load; that is, radiation, piping and any other connected load. They claim that steel heating boilers rated on this code have enough overload or reserve capacity to take care of the maximum starting load. After a careful check your committee has decided to accept these ratings with some slight modification."

CREDIT is due the Heating and Piping Contractors Buffalo Association for their enterprise in organizing a quantity survey bureau in that city. As is well known, such bureaus have met with success in the iron and steel, electrical and other building industries. They are in line with the activities of the administration in Washington in standardizing operations, and effecting savings in work, which otherwise would be duplicated at enormous expense. In having one separate bureau for furnishing all members with quantities of material, the Buffalo organization is working on lines which economically are sound.

Criticism of this plan has been made on the ground that accurate information is available for the small and incompetent contractor who thus is better equipped to compete with the well-organized and responsible contractor. The answer to this is that the contractor who, by reason of his incompetence or ignorance, has submitted bids at a low figure in which he has failed to include a boiler, pump or several hundred feet of 6-in. pipe, now will be competing with the more responsible contractor on the same quantity. This naturally will give more protection to the responsible contractor than ever before, for there is little consolation in seeing a competitor obtain the job on a low bid because he has not included all his material. It is no satisfaction to realize that in a short time he will be forced out of business. Quantity survey bureaus will go a long way toward eliminating the incompetent, rather than in aiding them.

Meeting Varying Requirements in Unit Heater Controls

by **G. D. Kingsland**

RARELY can a plant or building be found for which a single type of automatic unit heater control will satisfactorily serve all parts of the plant.

While a comparatively wide range of temperature, say from 55° to 65°, may be permissible in a work room where heavy labor is performed, and 40° to 55° may be satisfactory temperature in the storage warehouse, the office temperature should be maintained steadily, without fluctuation, at 72°.

There is no single type of automatic control that properly will meet all of these various conditions. But there are different types of controls for unit heaters; also sectional valve controls and individual radiator controls, with a combination of which any plant—no matter what the different temperature maintenance requirements in its various departments may be—can be so controlled that any part of the plant will receive just the temperature it needs.

Engineer Must Have Knowledge of Local Conditions

A thorough understanding of what all the different rooms and departments require as to degree and exactitude of temperature maintenance should be had by the heating engineer before he attempts to specify the particular types of controls which will be needed to properly control all parts of the building.

The simplest form of unit heater temperature control is the 110-220 volt thermostat mounted in series with the fan motor, opening and closing the motor circuit as the temperature rises or falls. This type of control, of course, is the least expensive and it is perfectly satisfactory where steam is always on the line, and where fairly wide fluctuations in temperature are not objectionable.* This method offers no protection against night running of motors where the steam is cut off and the thermostats consequently call for heat.

The next step is to add to the circuit a control** actuated either by temperature or pressure, as conditions warrant, mounted on the return flow line of the unit heater and wired in series with the room thermostat. The operation of this type of control, consisting of the room thermostat and the unit heater control, is as follows: The room thermostat demands heat, and if the return is at a temperature sufficient to insure delivery of air at proper temperature, the fan starts. If the return line is not warm, the fan remains idle. Should the steam supply fail after the fan has started, the unit heater will stop the fan before cold air is circulated. When the room reaches the desired temperature, the room thermostat breaks the motor circuit and the fan motor stops. Thus, by adding the unit heater control, protection is given against cold drafts and against the unnecessary operation of fan motors during those periods when the building is unoccupied and the steam supply cut off.***

As before stated, such unit heater controls will be found satisfactory where comparatively wide temperature variances are not objectionable. In those sections of the building where more accurate maintenance of temperature is desirable, the writer recommends the use of a low voltage room thermostat opening and closing the fan motor circuit through a relay. The low voltage thermostat may be adjusted to an operating differential of 1° or less.

Either system can be equipped with manually operated switches so that the fans may be used for ventilation during warm weather, or the thermostats themselves may be designed for automatic control during the summer period. The fans would be thrown into operation when the temperature reached 75° F., for example, and continued in operation until the temperature was reduced under the degree chosen.

Accuracy and prompt response in thermostatic operation where an even temperature is desired is a necessity where the starting and stopping of the fan are depended upon as a principle of control, for when the fan is stopped, the forced circulation stops and air stratification starts, the cold air falls to the floor, the warm air rises to the ceiling, and the advantage gained by forced air heating is lost. Therefore, if the time between fan operations is extended by lack of accuracy or lag in thermostatic operation, air stratification becomes so severe as to be a very decided objection, and the comfort range and benefit of active air (circulation) are lost.

Further investigation of automatic control of unit heaters, beyond the mere control of the fan, leads us into either the combined control of the steam flow and the fan or the control of the steam flow alone, maintaining the fan in constant operation so that active circulation is maintained at all times. Steam flow may be controlled either by controlling the producing medium or by controlling valves on steam flow mains.

For the purpose of heating comparatively small spaces where the steam to the unit is supplied by an independent boiler used for this purpose only, under certain conditions it is entirely practical to place the command of the boiler heating medium, be it oil, gas or coal, directly under a room thermostat so located as to take the average temperature of the space to be heated. Thus, when heat

is demanded, the room thermostat energizes the boiler heating medium and steam is produced. Here the operation of the fans is directly under the command of the unit heater control. Each unit heater may be equipped with an independent heater control or one control may be placed on the return line to the boiler, influencing the operation of the battery of unit heater motors as conditions warrant.

Thus, if the thermostat has demanded heat and the heat generating medium has produced steam in sufficient volume to fill the lines, the fan will be started and the heat properly distributed throughout the space in question. When the thermostat has been satisfied as to temperature, the heating medium will be shut down, and when the steam has been exhausted from the coils, the unit heater control will stop the fans, standing by until the thermostat again demands heat. This, in small installations, overcomes the necessity of maintaining a constant pressure at the boiler to supply the demands of the unit heaters, and therefore that fuel which is generally lost in maintaining a pressure not necessary to keep the temperature of the building at the proper point is saved.

This system may be enlarged to include any number of sections or departments as the building may require. Thus, in a building where there are departments requiring various temperature conditions, such as an office where a 72° temperature is desired, a machine shop where a 60° temperature is ample, storage space where 50° meets all requirements, and a department such as a paint shop where temperature requirements vary according to the class of work, progressing from 50° to 80°, all may be operated as independent units, calling upon the boiler to supply heat only to that particular section which requires heat. The control here is accomplished just as described previously with the addition of motorized valves mounted on the steam flow main to each individual department. The motorized valve is so designed that when it is called upon to supply heat, the valve is opened and the heating medium is energized. All other sections of the building being at proper temperature, the remaining valves will stay in a closed position and steam will be generated only in sufficient quantities to supply the one section where heat is demanded. In this case, the unit heaters are, as previously stated, controlled indirectly under thermostatic demand by the unit heater control.

Installation of Unit Heater Control System Results in Fuel Saving

Conservation of fuel in a system of this type is really surprising and the added efficiency of a temperature properly maintained to meet the requirements of each individual department is such as to pay a handsome return on effort and capital invested.

A study of government weather charts for any section of the United States will indicate that much heat is wasted where one central plant is called upon to supply several departments with varying temperature requirements. For instance, in the New England district, heat was required on all except four days in October, 1927, if an interior temperature of 70° was to be maintained. During the same period where it was necessary to maintain a temperature of 60° heat was required only 20 days. Where 50° was ample, heat was required only ten days. Consequently, if a heating plant was operated to supply steam to the mains and to unit heaters (though the fans are idle), in those sections where no heat was required, a great deal of fuel was wasted. This condition obtains commonly, even during the extreme heating months. At both ends of the heating season it is decidedly pronounced.

Whenever constant operation of the fan to avoid air stratification is indicated as desirable, several types of control may be adopted. In this classification, however, conditions vary so widely according to the requirements that no concrete rules can be set down as to how the best results can be accomplished. Motor speeds may be varied; these speeds, however, must be based upon air delivery necessary to maintain circulation throughout the space heated and differ in each installation. Conditions dictate whether there should be full or partial cutoff of steam. A combination of fan speed variation and steam cutoff may be the proper method.

It becomes apparent, therefore, that the choice of automatic temperature control of unit heaters, or of combined unit heaters and direct radiation, should be based upon the temperature requirements of each department or section of the building. No one type of control can be expected to properly serve any building in its entirety.

It is natural that with the ability of the unit heater to direct the heat stream, the elimination of air stratification, thus avoiding the high ceiling and low floor temperatures consequent to other types of heating, the brief heating-up period and the almost total elimination of heat delivery when the fan is stopped, that this modern method of space heating should be so rapidly increasing in popularity. But these very virtues inherent in unit heating which cools so quickly when not in operation and heats so soon when operating, require automatic control far more than the older types of heating did if the maximum comfort and economy are to be realized.

Discussion

*There is a difference of opinion among manufacturers as to whether fairly wide fluctuations are a controlling factor.

**The control mentioned here, according to some manufacturers, should be a limit control placed not on the return line, as mentioned by the author, but on the steam supply line to the unit heater.

***One manufacturer states that "on large unit heaters, magnetic starters or relays may be used. On such installations the thermostat and limit control, if one is used, will only be required to handle the load of the magnetic coil. This arrangement may also be used where it is desired to control groups of unit heaters. On some installations it is desirable to use relays having low-voltage control circuits, thus permitting the use of low-voltage thermostats and limit controls."

There is some question on the part of manufacturers as to whether line voltage thermostats, controlling unit heater motors direct have a wide differential. One manufacturer states that there are a number of thermostats on the market which maintain less than a 2° differential on line-voltage installations.

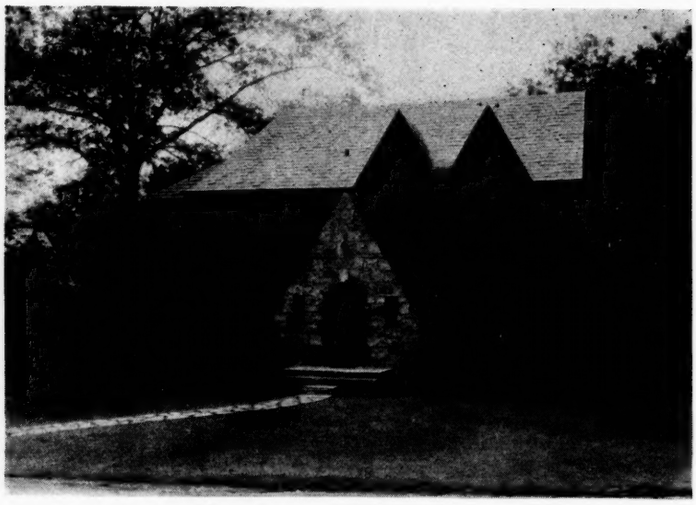

Fig. 1. Exterior View of a Modern Home, Eight Rooms, Two Baths, Heated by a Converted Round Coal Boiler

House-Heating by Gas

by C. GEORGE SEGELER

Industrial Editor, American Gas Association

THE question is frequently asked why gas boilers are so much smaller than coal boilers supplying houses of the same size. The answer is that the burning characteristics of gas permit smaller combustion chambers to be used and that the excess air required is less than that required for other fuels, and that no draft is required other than that produced by the boiler itself, making the use of narrower flue passages desirable. Moreover, the burning of gas produces a constant supply of heat which permits gas boilers to be selected with a capacity nearer to the connected radiation load than is desirable in coal boiler practice.

A typical coal boiler with a commercial rating of 1050 sq. ft. steam radiation (output at the boiler) will measure about 57 in. x 36 in. x 25 in. and would be used in a house with about 500 sq. ft. of installed radiation. A gas boiler for the same house would be selected with a capacity of 780 sq. ft. and this would have dimensions of about 53 in. x 26 in. x 25 in.

Rating of Gas Boilers

In accordance with the idea of A.G.A. approval, all boilers are tested under the same conditions as laid down in the approval requirements for central house-heating appliances. On satisfactory completion of test, the boiler can be supplied with a seal and label showing the official input and output ratings. The former is expressed in B.T.U. per hour and the latter in terms of square feet of steam or water radiation output of the boiler. The full rating must be delivered by the boiler when operating without a flue connection and without producing any carbon monoxide in the flue gases. The thermal efficiency must be not less than 75%. Boilers bearing the A.G.A. rating can be depended upon to deliver the designated amount of heat.

Catalogs of leading manufacturers list boilers in sizes from 150 sq. ft. of steam radiation up to more than 12,000 sq. ft. With the greater accuracy of rating and calculation practised in gas work, the interval between boiler sizes is quite narrow. Less than 100 sq. ft. difference will be found in some lines of boilers in the smaller sizes while a 500 sq. ft. spread may be found in the larger ones. It is possible to select a boiler of the exact theoretical size desired, thus keeping down the cost of the installation without sacrificing on available heating capacity.

Selection of Boiler Size

Standard practice for selecting boilers for domestic installations is to use the A.G.A. selection factors which make suitable allowance for both quick starting under thermostatic control and for the radiation loss from piping. These factors are given in Table I.

Naturally enough a good many special cases will arise even in domestic installations where the application of selection factors would not be desirable. There can be no substitute for intelligent judgment, but the table may be used as a guide. It covers thermostatically controlled installations with direct radiation whether steam, vapor or water; inside temperature of 70° F., and normal amount of piping.

For other than domestic installations it is best to measure the equivalent load of the piping and to add this to the installed radiation. Then an allowance for quick starting under thermostatic control can be added before selecting the size boiler desired. This factor ranges between 15% and 25%, depending upon the details of the installation.

For other kinds of radiation than cast-iron direct, reference to Table II may be of assistance. This shows

TABLE I

SELECTION FACTORS FOR GAS BOILERS

Installed Radiation Sq. Ft. (either steam or water)	Factor	Size of Boiler Sq. Ft.
100	1.56	156
200	1.56	312
300	1.56	468
400	1.56	624
500	1.56	780
600	1.552	932
700	1.545	1082
800	1.537	1230
900	1.53	1377
1000	1.523	1523
1500	1.486	2230
2000	1.45	2890
2500	1.437	3595
3000	1.424	4270
3500	1.412	4950
4000	1.40	5600
over 4000 sq. ft.	1.40	....

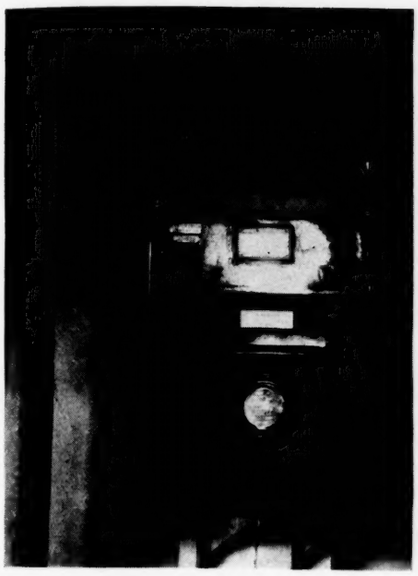

Fig. 2. Meter Setting, Showing Shut-Off Cock at the Left

All gas requirements, including house-heating, are supplied by this meter.

in Item 1 the square feet of radiation which would be installed in a building requiring 1000 sq. ft. of standard direct cast iron. Depending on the emission there would be varying amounts of "indirect," "direct indirect," etc. To obtain the equivalent square feet of direct cast-iron radiation the values in Item 1 have been multiplied by the factors shown in Item 2. The results are given in Item 3. Then in Item 4 the instruction is given to add the measured risers and returns (or in absence of this information) to add the percentage shown. Item 5 gives the percentage increase to take care of the starting load. Finally in Item 6 the boiler size, representing the total of Items 3, 4, and 5, is given.

TABLE II

EQUIVALENT SQ. FT. OF VARIOUS FORMS OF RADIATION AND BOILER SIZE REQUIRED

Item No.		Standard Direct Radiation	Standard Indirect	Standard Indirect Recirculating	Vento Indirect Without Fan Gravity	Vento Indirect Recirculating Without Fan Gravity	Direct Indirect
1.	Sq. Ft. of Radiation Installed	1000	1450	1300	1230	1060	1300
2.	Factor to obtain equivalent direct cast-iron radiation..	1	1.7	1.3	2.0	1.6	1 2
3.	Equivalent direct cast-iron radiation	1000	2465	1690	2460	1695	1560
4.	Measure risers and returns or add	22%	10%	10%	10%	10%	22%
5.	Starting load, add.....	25%	10%	15%	10%	15%	20%
6.	Boiler Size Required, Sq. Ft.	1523	2980	2140	2980	2140	2280

No phase of the gas house-heating business is arousing more discussion than the question of whether it is better to install new, all gas designed equipment, or to add a gas burner to the existing heating system in the house, just as oil burners are installed in existing heating plants. Only a few years ago gas engineers were, in general, of the opinion that it was unsatisfactory to attempt changing over existing coal heating plants to gas firing. It was necessary, so it was argued, to use nothing but all gas-designed equipment.

It is undoubtedly true that all gas-designed equipment represents the best method of gas house-heating, but nevertheless there are many cases where the local situation dictates the use of an automatic burner installed in the existing heater, rather than to remove the existing equipment. This article will discuss the factors which should be considered in making a decision along these lines.

When to Convert a Coal Heating Plant

There are three viewpoints to bear in mind, and they can be taken up in the following order:

First, and foremost, the viewpoint of the customer.

The customer saves decidedly in the first cost of a converted system over what it would cost to install a gas-designed unit. Certain accessories are common to all gas-burning systems. These include the gas pressure governor, the room temperature thermostat, motor valves, etc. The biggest single item of saving is that of the purchase and erection of a new casting for the boiler (conversion of furnaces will be given a separate treatment later. This amount is such that it can roughly be estimated that installed gas burners will cost around $250 to the customer, compared with a gas-designed unit at $600.

This saving in first cost also brings with it an annual saving in fixed charges. However, most customers do not calculate their heating plant on any accurate bookkeeping basis, and charge off the entire cost of improvements in their home to annual operation, and then consider no further interest charges.

Offsetting the saving in first cost is the possibility that the efficiency of the converted system will be less than the efficiency of a gas-designed system, with a resultant operating charge proportionately higher.

In a previous article of this series, the required efficiency to secure A.G.A. approval has been discussed at length. There is no reason why many gas burners installed in existing coal plants could not be made to yield the same efficiency provided that the boiler possessed adequate heating surface, and that the installation of the gas burner was made in the best possible manner. In practice, however, it is not always practical to provide the same degree of engineering supervision to the installation of gas burners in coal plants as could be applied to the design of an all gas system, and therefore a nation-wide survey will indicate that in general the efficiency of converted coal plants is reckoned anywhere between 5% and 20% lower than that of gas-designed systems.

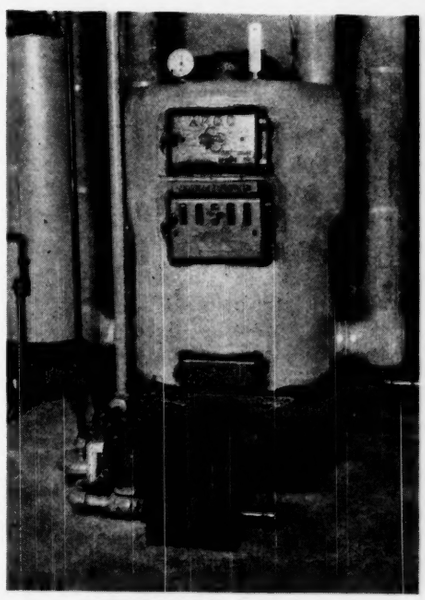

Fig. 3. Assembly of an Automatic Gas Burner Applied to an Existing Round Coal Boiler, Supplying 722 Sq. Ft. of Water Radiation

The customer, therefore, can calculate for himself whether he would prefer to have the assurance of the best that there is available, with the lowest possible operating cost, or whether he wishes to save on first cost and slowly make up the differential by a slightly higher annual fuel charge. In an annual heating bill of $250, a difference of 10% would amount to $25, and on that basis fourteen years would elapse before the difference in first cost had been absorbed.

Second, the viewpoint of the contractor.

The contractor views the installation of gas burners with two thoughts in mind: merchandising possibilities and technical problems. Because of the lower first cost, there seems no question that a larger volume of business can be done with the automatic gas burners, and there may be some reason to suspect that a higher percentage profit can be earned on these appliances. At first sight they are extremely attractive, but on the other hand the contractor bears the technical phases in mind. He must be prepared to service the particular burner which he is marketing. In many cases this might be the same make which the local gas company is selling, and in that event the servicing problem would be made much easier because the gas company would undoubtedly undertake the work of servicing.

However, assuming that an independent make is being handled, the contractor would have to bear the brunt of servicing costs. It is not the function of this article to decide whether these would cut more deeply into earnings than would a somewhat smaller volume of business done with approved makes of gas-designed boilers. However, in addition to the servicing of installations, there is also the possibility that the contractor will be less familiar with the intricacies of gas-burning systems, and may feel some hesitancy about guaranteeing his installations.

The best plan for the contractor to follow, all things being considered, seems to be to work hand in hand with the local utility companies, and to try to secure the benefit of their expert knowledge in this particular field.

A little later in this article some of the technical details which may be of use to contractors who are new in this field will be discussed.

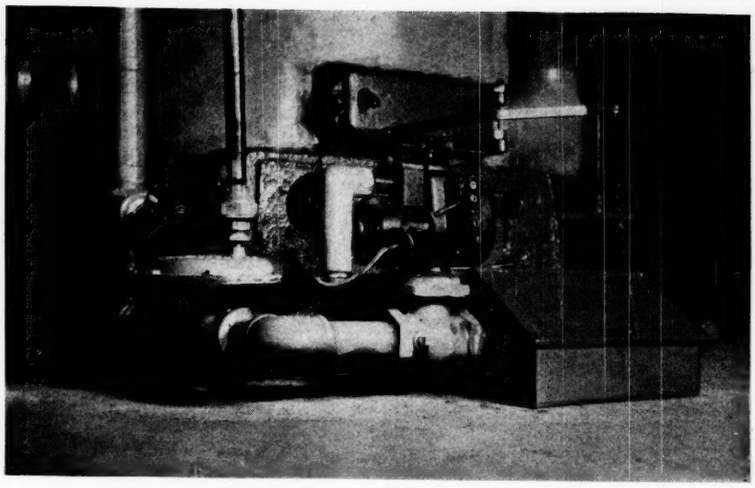

Fig. 4. Close-Up View of the Automatic Gas Burner

At the left is the hand controlled valve, then the gas pressure regulator, on the top of whose diaphragm the vent pipe leading to atmosphere can be noted. This pipe protects the house in case the diaphragm of the regulator should rupture. The end of this vent line is out of doors, and is capped to prevent accidental stoppage. The motor valve controlling the gas supply is the next unit. As the motor valve rises, the lifter strikes the pivoted bar and raises the damper. This damper is the control damper for the secondary air supply to the boiler. When the gas is off, this damper is shut, thereby stopping the flow of cold air through the boiler during the off periods.

Third, the viewpoint of the gas company. Many gas companies have steadfastly adhered to a policy of installing only gas-designed boilers. This was a very natural policy because in the experience of every company selling gas for house-heating there will be found instances where local inventors have designed gas-burning equipment for converting coal boilers which was locally sold and installed, and caused most unfortunate results. It would but weary the reader to listen to a recital of the many and curious things which have been done in this field. In any event, it was a very natural defense on the part of the gas companies to insist that only gas-designed equipment be used.

Fortunately, those days are past, and there are now on the market splendid burners for changing over coal boilers and furnaces to gas operation. Such units come equipped with every modern accessory and safety device, making them fully the equals of gas-designed equipment as far as their operation is concerned. It is about such appliances that this article is written, and it is earnestly hoped that every contractor reading these lines will consult with the gas company before he takes on a line of gas burners. Every gas company in the country will be glad to advise its local contractors on the merits of a combustion system, and the advice of the company can be followed to the great advantage of all parties concerned.

So much for the factors which should be considered in deciding about the use of gas burners. There is, however, another important item in respect to which one might refer to page 63 of the January issue of HEATING AND VENTILATING in which the difference between manufactured and natural gas is discussed, because the lower the price of gas, the less important does the difference in efficiency between gas-designed and converted systems become. In fact, there are large areas supplied by natural gas where it is general practice to convert existing boilers, and only to use gas-designed systems in new homes.

(*To be continued*)

April Business Above March

In a summary of business conditions and prospects, reported by Dr. Frank A. Fall, Director of Education and Research, at a recent convention of the National Association of Credit Men, 80% of the replies to a questionnaire showed that in the plumbing and heating field sales in April, 1930, compared with April of last year were lower, while 60% replied that business for April was better as compared with March of this year.

Automatic Heat with Solid Fuels

by **NOEL CUNNINGHAM**

UNDERFEED stoking originated in the Jones stoker, patented in 1867. This was a heavy plunger which on its back stroke received a charge of coal and on its forward stroke forced the charge through a throat into the fuel bed. A little later there came into use powerful screw feeding devices for conveying the coal through the throat into the fuel bed. Grates were eliminated by providing retorts with slotted tuyeres for introducing air, the ashes flowing onto dead plates at the sides of the combustion chamber. Fires were cleaned by hoeing out the ashes and slicing the clinkers away from the tuyere openings. It became standard practice to use forced draft with blowers.

Modern industrial stokers maintain the general principles of the original designs, improvements being confined chiefly to refinements in heat-motion construction and air control. The great majority of industrial stokers are of the heavy screw feed type, although the plunger type in which coal is forced through the throat into the fuel bed is still in extensive use.

Screw feeding has the advantage of not requiring such massive construction as the original plunger feed type. The screw feed also reduces crushing strain on the coal in the process of feeding and allows better control of distribution through the fuel bed. This type is well adapted to smaller units installed in commercial buildings, whereas the plunger stoker, as originally designed and as still used, is better adapted to power plants and large commercial buildings.

An important development of the plunger feed in commercial stokers has been the extension of the plunger to form a conveyor through the feed throat into the retort. This relieves the heavy strains on the head motion and allows lighter construction than is possible using the extrusion feeding arrangements such as is used in the Jones type of stoker.

This has the same effect as the screw feed in reducing crushing of the coal which, in the extrusion type of stoker, has to transmit the full force exerted by the plunger. The pusher is a reciprocating bar provided with lugs faced in the direction of coal travel and beveled in the reverse direction. It is virtually a rigid flight conveyor for carrying coal through the feed throat and into the retort where combustion takes place. The spacing of the lugs within the retort controls the evenness of the distribution of the coal through the length of the retort. This form of plunger is well adapted to use of a hydraulic drive, allowing the placing of the fan and the drive mechanism at some distance from the boiler.

Fuel for underfeed industrial stokers has been almost exclusively bituminous coal. Lately there has been some use of anthracite buckwheat sizes and mixtures of rice (No. 2 buckwheat) and of barley (No. 3 buckwheat) with bituminous slack, especially in the hydraulic drive plunger conveyor stoker. Anthracite has sufficient mechanical strength to maintain its structure; it is non-caking, and, due to comparative regularity of air travel through the fuel bed, gives a more even fire than bituminous slack.

Range of underfeed industrial stokers has increased downward from large to small industrial plants, then into large commercial buildings and finally to small commercial buildings. Light industrial models are now in considerable use in heating plants with as little as 2000 sq. ft. of installed steam radiation. Small commercial building under-

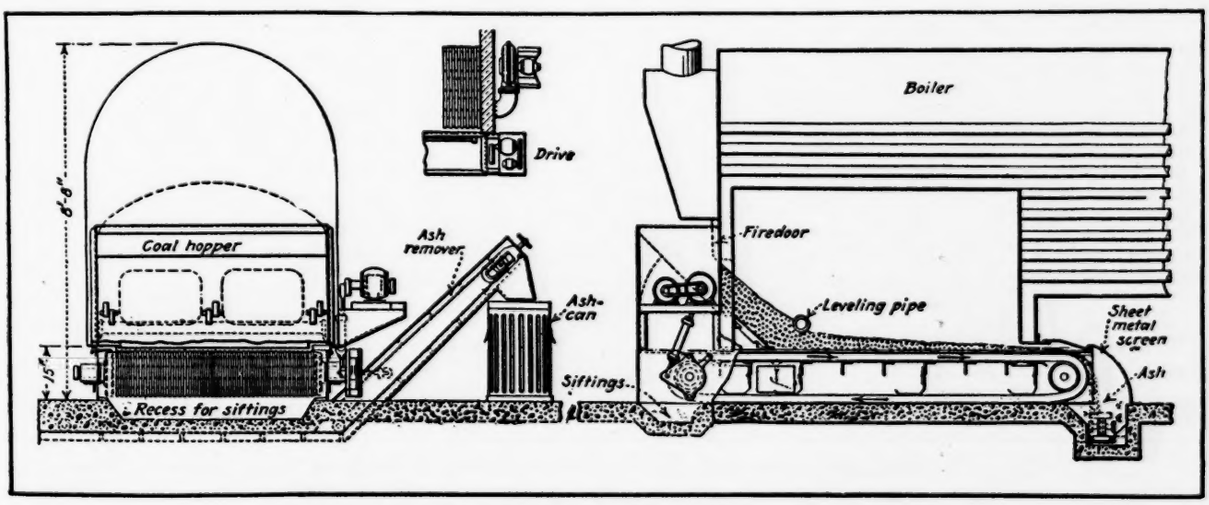

Fig. 1. Chain Grate Stoker for Large Commercial Buildings

Operates best using rice size anthracite. Rate of feed is constant, heat output being controlled by starting and stopping the stoker. Depth of fuel bed is controlled by height of levelling pipe. By means of wind boxes between the chain grate surfaces, air delivery is controllable through various portions of the fuel bed.

feed models are operated usually with ½ H.P. motors and are applicable to heating plants using as little as 200 tons of coal per season.

In developing automatic equipment of the underfeed type for small building heating the general principles which have proved successful in industrial underfeed stokers have been followed. The essential considerations are light construction, small power input and correlation of heat delivery with house requirements. Automatic ash removal is generally considered essential although devices are being successfully marketed which do not provide this feature.

When a screw feeds the coal through a tube the diameter, pitch and speed of the screw determine the rate of feed. Power input is that required to rotate the fan plus the power required to operate the feeder. Air is supplied at low pressure (⅜ to ¾ in. water gauge), and the maximum volume is dependent upon maximum rate of coal feed.

Screw feeds for small stokers are from 3 in. to 3½ in. in diameter, and those for small burners from 2 in. to 3 in. Small stokers are normally not designed with adjustable rate of coal feed. While the machine is operating a definite amount of coal is delivered to the fuel bed along with the correct quantity of air to burn the amount of coal delivered. When the thermostat is not calling for heat the coal feed is stopped, and the only air supply is that due to the natural draft. Rate of coal feed depends upon the size of the machine and ranges from 20 to 60 lbs. per hr. Arrangements are usually provided for starting the machine at intervals in order to assure maintenance of fire, even when the thermostat is not calling for heat.

Some burners operate intermittently in the same manner as stokers, except that when the thermostat is not calling for heat the timing device must cut in at more frequent intervals than is the case with stokers, because the burners have little fire-pot storage capacity.

Another system of burner operation provides continuous coal and air delivery throughout the heating season, the feed being graduated to the heat requirements of the house. When little or no heat is required the feed drops to a minimum, which, according to the size and setting of the machine, varies from 1 to 4 lbs. of coal per hr. The relative advantages of continuous and intermittent operation will be discussed later.

Power Required Depends on Coal Feed Capacity

Power required to operate any stoker or burner depends to a considerable extent upon fan capacity which, in turn, is predetermined by maximum coal feed capacity. In a small screw-feed burner another important factor determining power consumption is the weight of the screw itself. A light, small diameter screw is an advantage from the standpoint of power input which, as an item of customer expense, should be kept at a minimum.

Opinion is divided as to the relative advantages of heavy cast screws compared with light ribbon screws. Cast screws 3 in. or more in diameter require considerably more power than light ribbon screws of approximately 2 in. diameter.

However, the heavy screw and the more powerful motor and gearing have certain advantages when it comes to withstanding strains and cutting through blockages. On the other hand, the heavier overall construction increases manufacturing cost, which must be absorbed in the price the customer must pay for the machine. The greater weight of the moving parts also adds to the power consumption.

One small burner employs a reciprocating plunger conveyor feed. Owing to the design of the plunger the coal travels freely through the feed tube into the fire-pot. There is no packing of the coal as it passes through the tube, and obstructions travel freely with the coal. This makes possible the use of light moving parts with a consequent saving in power.

With devices employing plungers difficulty has been encountered in preventing the coal from packing in the feed tube. A plunger feed recently introduced provides parallel push shoulders throughout the length of the plunger, the shoulders being spaced progressively closer together as it approaches the end which enters the fire-pot. Thus the coal tends to travel faster as it progresses through the feed tube. The delivery end actually pulls the coal from the feed end and there is no compressing action of a portion of the fuel in the feed tube pushing that ahead of it.

The plunger feed has an advantage in its ability to handle wet coal. It is important that coal for heating plants should at all times be kept damp for cleanliness, but it is difficult to maintain a steady, uniform feed with damp coal where a screw feed is used. Also, when an attempt is made to keep the coal damp at all times, portions may often be so wet that it cannot be handled satisfactorily with a screw feed.

Impulsion burners are an out-

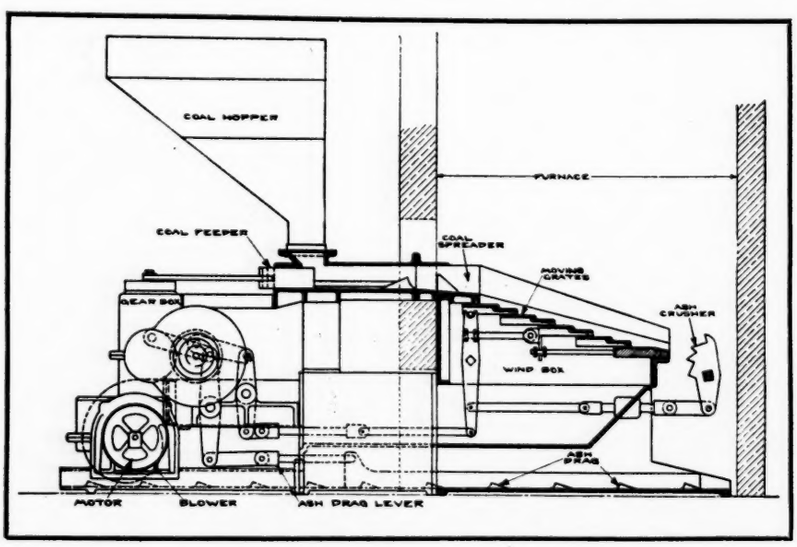

Fig. 2. Operates Best on Buckwheat or Rice Anthracite

Rate of feed is constant and heat output controlled by starting and stopping the stoker. Push feed from hopper over spreader plate to the stepped grate is provided with horizontally reciprocating bars.

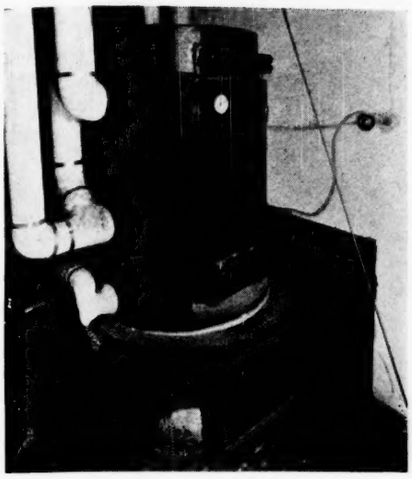

Fig. 3. Revolving Grate Burner for Domestic Heating

Operates best on buckwheat or rice anthracite. A special boiler is required. Illustration shows unit arrangement for combination gravity and mechanical feed from coal bin. Rate of coal feed is determined by position of deflector controlled by house thermostat or boiler regulator. Coal from feed plate delivers to periphery of revolving annular grate with central round opening for ash discharge. Fuel bed rotates with the grate and is caused to travel radially from the periphery of the grate toward the center by a stationary eccentric wall projection. Illustration shows front of coal bin at right of boiler.

growth of power plant equipment of the chain grate, dump grate and reciprocating grate types in which the fuel bed travels through a combustion chamber from a feed end to a zone of active combustion and thence to an ash delivery end. Both chain grates and reciprocating grates have been successfully applied in equipment now available on the market for large commercial building heating plants. The problem in their application to standard fireboxes is so to minimize the proportionate space required to accommodate feed and ash delivery that the area remaining for active combustion will suffice to develop the heat required to maintain boiler ratings.

It is evident that, in the impulsion type burner, the smaller the fire-box the smaller will be the active combustion space, as the space for raw fuel and ash removal zones will be almost the same, irrespective of the size of the fire-pot. This explains why, in the development of burners for use in standard household heaters, the underfeed burner has had greater appeal than the impulsion type. With underfeeding the area occupied by the raw fuel pre-empts none of the combustion space within the fire-box.

To date there has appeared on the market no impulsion type household burner which can be applied readily to standard house heaters. One very ingenious device is illustrated. A fuel storage is provided on an extension of the burner base. A circular plate slowly rotates under a central bottom outlet from the storage. On this plate there is at all times a cone of fuel, the steepness of whose sides is determined by the angle of repose of the material. A deflector cuts away a portion of the toe of this cone of fuel and leads it into the burner. The position of this deflector is adjustable and is regulated by the thermostat. The amount of fuel fed to the burner is thus dependent upon the house heat requirements.

The drive which actuates the feed plate also slowly rotates the circular grate, the only moving part of the burner proper. A spiral lug cast on the inside of the burner wall projects over the edge of the revolving grate. This lug has a zero projection at the point where the raw fuel spills onto the periphery of the rotating grate, its projection increasing in the direction of the grate travel. The fuel bed, rotating with the grate, is progressively restricted and the material comprising the bed is crowded toward a round, central opening through which the ashes drop to waste. The projection of the spiral is greatest immediately ahead of the point of peripheral fuel intake and thus a clear grate space is made available for new fuel.

Under the rotating grate is an annular air chamber into which low-pressure air is forced by a blower, the volume of air being proportioned to the coal delivery by a blast gate. The movement of the gate is controlled by the position of the blade which deflects the coal feed from the feed plate into the burner. As soon as new feed is laid down it comes into contact with incandescent fuel already on the grate and is ignited. During the hour or more that the fuel remains on the grate combustion is complete.

This impulsion burner is built in three sizes having capacities ranging from 1000 to 3000 sq. ft. of total steam radiation. It has been on the market for about three years and appears to have reached a high stage of practical development. A special boiler is built to set on the burner although any round boiler of sufficient capacity can be adapted to its use. However, when an existing boiler is to be used, the boiler base must be discarded. It is usually preferable completely to replace the boiler, as the expense of adapting the boiler portion only in existing equipment may not be warranted when compared with the increased satisfaction secured by providing an entirely new balanced unit. In a new house installation the complete unit is usual, the special boiler costing no more than any standard boiler of equal capacity.

The general idea of the impulsion burner, a controlled quantity of fuel undergoing complete combustion in a definite time, is the ideal development in heating with solid fuel. In the instance cited it is of interest to consider the extent to which ideal results are secured.

Travel of the fuel bed is radial over a circular grate, raw fuel being laid down around the periphery and ashes being voided through a hole in the center. No combustion space within the boiler water leg is taken up with raw fuel as this enters outside the radius of the heating surface. By the time the new fuel reaches the water leg it is in active combustion. The elimination within the firebox of space for raw fuel has two important effects. A maximum combustion zone is secured and the long flame from the burning of volatile gases immediately contacts the coldest heating surfaces and effects almost perfect heat transfer from the flame to the boiler water.

Another important feature is automatic compensation for shrinkage within the fuel bed due to burning off of combustible. At the same time that this shrinkage is occurring the travel of the fuel bed toward the center is causing a compacting action. The impulsion burner reverses the action which takes place in the underfeed burner. In the latter raw fuel is admitted at the center and combustion starts within an area having the general shape of an inverted cone. The long flames from combustion of gases are given off centrally in a zone farthest from the cold water leg of the boiler. Fuel travels radially to the periphery and becomes less compacted as shrinkage occurs.

Compressing the ashes in the impulsion burner has the effect of eliminating cracks through which air can pass without useful application, whereas cracking of the ash crust is difficult to avoid in the underfeed burner. A tendency to incomplete combustion, stack loss due to excess air and the greater difficulty of obtaining the best utilization of heat from combustion of gas are points which must be carefully studied if underfeed burners are to equal the efficiency of utilization of fuel heating value which is secured in the small impulsion burner. Depending upon the boiler and set-up, boiler efficiencies using underfeed burners in standard cast-iron boilers vary from 60% to 75% as compared with efficiencies of 72% to 85% using an impulsion burner in its special boiler.

There is very little concrete published information as to cost, correct practice and operating results using solid fuel burners in household heating. It is only in the eastern states where fine sizes of anthracite are readily available that the use of solid fuel burners in small heating plants has reached a considerable stage of development. Any discussion of the subject must necessarily refer to the conditions as found in this area.

As has been stated, Pennsylvania anthracite buckwheat and rice are the only two fuels which are satisfactorily used in burners which automatically feed coal according to the heat requirements and concurrently remove ashes. The quality of these fuels, during the last two years, has become established by operating and marketing conditions. Specifications still vary somewhat but no important producer is shipping material having a fuel value of less than 12,000 B.T.U. per lb. Price at the mines has not varied appreciably during the last ten years and an advance is anticipated only when research indicates that, by special and more costly preparation, quality, burning characteristics and consumer satisfaction can be improved. In Pennsylvania, New York, New Jersey and eastern Connecticut, $8 to $10 per ton is a usual price in the customers' cellars, variation being due to difference in freight from the mines and variations in cost of doing business in different communities. Further from the mines, in Northeastern New England and around the Great Lakes, delivered prices reach $12.

Burner equipment is applicable to all existing heaters and systems of heating, steam, vacuum, hot water or warm air. Entirely satisfactory installations have been in use for over five heating seasons. An upkeep expense to customer of not over $15 per single burner unit per season it has been found will maintain a machine in good mechanical repair practically indefinitely.

Several burner designs are in greater or less present general use, some having features not possessed by others. It is not practicable to give much detail or comparison but it can be stated that users are very generally satisfied with the results obtained, irrespective of what burner is used. All have only a few inexpensive moving parts and these are in slow motion involving very gradual wear. In every case considerable wear can occur before parts replacement is necessitated and complete break-down and stoppage can involve nothing more serious than the fire going out.

Installed costs of burner units vary somewhat with the make and capacity of machines. The following tabulation is merely to give an approximation to compare with heating equipment using other fuels.

APPROXIMATE COST TO CUSTOMER OF ANTHRACITE BURNING EQUIPMENT

Capacity in sq. ft. of steam radiation at boiler or equivalent	Tons of coal per heating season in ordinary service	Electric power kilowatt-hours per month at meter	Approximate installed price without controls to customer	Additional cost of controls varies with customer's requirements
Up to 600	Up to 18	60— 70	$350—$500	
600— 800	18—26	70— 90	400— 525	
800—1000	24—32	90—100	525— 650	$50—$150
1000—1500	30—48	100—120	750—1000	
1500—2000	45—65	120—180	*750—1300	

*The lower figure is for an installation which requires a special burner.

Fig. 4. Underfeed Burner for Domestic Heating

Arranged from gravity coal feed from bin, buckwheat or rice size anthracite being the fuel. Operation is continuous, coal feed and air delivery synchronized and rate of feed controlled by house thermostat and heater regulator. Ashes removed to can on cellar floor.

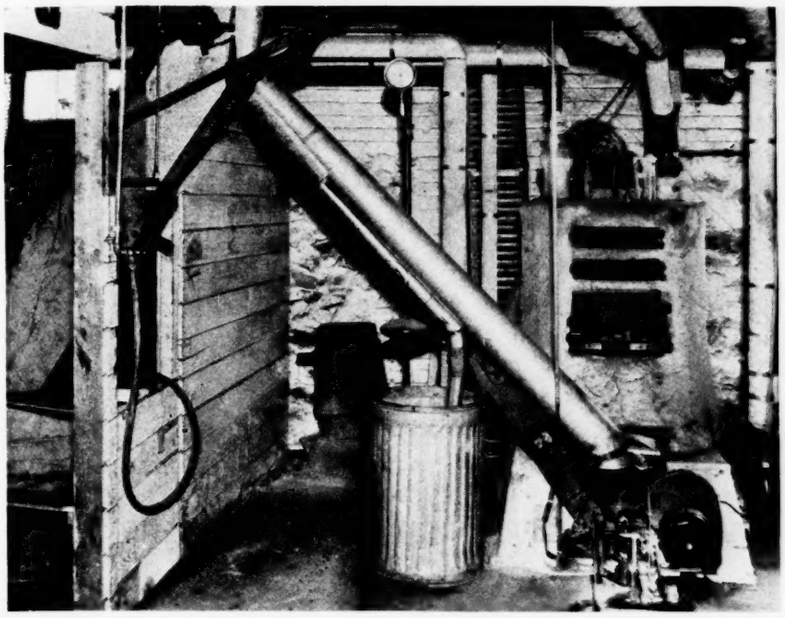

Fig. 5. Domestic Burner with Automatic Coal-Feeding Elevator

The elevator is operated by the stoker and delivers coal from the bin to the hopper direct and screens out the fines and sand. This is made possible by the fact that the machine will handle wet coal.

It is often desirable to arrange for feeding direct from the coal bin into the burner. This is being done in two ways, by preparing a special bin and flowing the coal by gravity or by mechanical arrangements that elevate the coal. These arrangements have not come into general use but may be important in future extension of burner application.

There are no exact figures on the cost of a gravity arrangement. In exceptional circumstances it may be practically nothing, in other cases it may run to several hundred dollars. Mechanical arrangements are available both to operate from the burner head motion and through a separate drive. The cost installed is from $75 to $150, depending upon the distance coal must be transported.

Much study has been devoted to the development of apparatus for moving ashes from the cellar to a container outside. This can be done with present available means, but the installations are costly and practically untried. It is not probable that saleable equipment for this purpose will ever come into widespread use. It is a fact that arrangements can be made for ash collection from the cellar at a cost, over the entire season, so small that it will be less than interest and upkeep cost of equipment for doing the work mechanically.

The effectiveness of the modern anthracite burner in regard to the efficiency of fuel heat utilization has not been generally appreciated. Properly installed in a good heater adapted to burner use, a large number of coal burners running on anthracite small sizes are equalling efficiencies obtainable with other fuels considerably more costly per unit of heat even when these are burned in specially designed heaters. Where automatic heating is being considered the modern coal burner has earned for itself a definite place. It is the only equipment for this purpose which pays for itself by its own savings, and at the same time meets heating requirements for convenience with cleanliness and safety.

Action of Heat in Relation to Materials Used for Insulation

WITHIN the last five years there has been great activity in the field of heat insulation, particularly for dwellings, according to Dr. J. L. Finck, of the Heat and Power Division, Bureau of Standards.

A large number of different materials have been utilized in the manufacture of insulating products of various kinds. Moreover, there are numerous other raw products, now considered waste, which may be equally suitable for this purpose.

Anticipating the need for additional data, the Bureau of Standards has been conducting a study of the insulating properties of various fibrous materials. Tests have been made on jute, cotton, flax, wood fiber, bagasse, cornstalk fibers, moss, excelsior, wood shavings, etc. From an insulation standpoint, alone, there is practically no choice between the different commercial grades of these materials. The waste or poorest grades, therefore, may be commercially available for the manufacture of heat insulating materials.

Tests were made of each material packed to different densities ranging as widely as practicable. It was found that each fiber has an "optimum" density at which the thermal conductivity is a minimum or the insulation value a maximum. Where the only consideration is maximum insulation with the least amount of material in a given space, this suggests that the materials should be packed at these "optimum" densities.

In these tests considerable attention was given to the mechanism of heat flow, and it was found that for a given fibrous material and a given density, the heat conductivity may vary by several hundred per cent, depending entirely on the arrangement of the fibers. The maximum conductivity, it was found, is obtained when the fibers are parallel to, and the minimum conductivity when the fibers are perpendicular to, the direction of heat flow.

At very low densities it was found that the prevailing form of heat transfer is by radiation; air convection plays a very minor part.

Air Conditioning

II. Ventilation—General Discussion

by **WILLIAM HULL STANGLE and HENRY WARREN KINGSBURY**

VENTILATION is not air conditioning, although a space which is equipped with an air-conditioning system and maintains the desired standard synthetic atmosphere is adequately ventilated. In this discussion ventilation is considered as part of air conditioning although the full equipment necessary to maintain the standard atmosphere may or may not be installed.

Both supply and exhaust ventilation is required and must be operated simultaneously. If the air is filtered, treated with ozone or "radion" to remove odors, dehumidified, and warmed or cooled as necessary, probably as much as 75% may be recirculated.

If a space has a comfortable temperature, is free from odors, and has gentle but definite air movement with no drafts it is well ventilated.

Supplying a certain quantity of air whether it is 2 c.f.m. per sq. ft. of floor area or 30 cu. ft. per person does not mean that the space is well ventilated. It must be comfortable.

Comfort is most important. It is Nature's way of telling us that our immediate surroundings are satisfactory for our health. If there are elements present which dull our senses this is not true. Overheating does not cause the same degree of discomfort as underheating or drafts and is not as dangerous to the health.

If a space is cold and drafty with the ventilation equipment running it would be better to stop the system and do without ventilation. The lack of ventilation with the resulting increase in odors will usually prove less objectionable than too low temperatures. If the occupant can and will compensate for the low temperature by wearing warmer clothing, the low temperature will be preferable but a comfortable temperature is most desirable.

Drowsiness is not an indication of comfort but usually is an indication of a full stomach and an overheated body. In large spaces such as auditoriums, restaurants, etc., drowsiness is not caused by lack of oxygen but usually by the lack of air movement and by warm surroundings.

In a theatre, restaurant, dance hall or other places of public gathering we install air-conditioning systems for one reason only and that is comfort. And if the majority of the occupants are comfortable the space is adequately ventilated.

The quantity of air supplied and exhausted is not dependent on the square feet of floor area, the cubage of the room or the number of occupants; the quantity is dependent only on the amount of heat and moisture to be added or subtracted. The volume of air must be large enough so that the difference in temperature between the air supplied and the space treated is not large. This is most important during those periods when the space needs cooling and air is supplied below the room temperature. If it is too large we may expect complaints about drafts, freezing and the like.

In spaces with low headrooms this difference in temperature may not exceed 5° F. and in spaces with high headroom, such as a theatre, this difference may be 20°.

The volume of air is determined by the maximum condition and should be constant. Otherwise the distribution is changed and we may expect both high and low temperature zones. The speed regulator should be used only as a starter after the correct speed has been determined. In the writer's opinion the best results would be obtained if constant speed motors were used and the temptation to vary the volume according to occupancy were thereby removed.

All sources of heat must be taken into consideration. Heat is generated by the occupants, the lights, food, sun effect on walls and roof, motors, and in some cases by other heat producing equipment, such as that in organ lofts, steam tables in cafeterias, etc. Moisture is added by the occupants, food, steam tables, plants and similar equipment.

A common system will not be used successfully for two dissimilar spaces. Thus the system supplying a theatre can not be used to supply air to a cafeteria. The two spaces have entirely different requirements and one of them would be left uncontrolled and the space treated would not have the correct temperature and humidity. Refrigerating equipment is not considered in this statement as part of the system, it bears the same relation as the boiler.

In the past we have usually considered a comfortable temperature as 72°. Today we know that this temperature is sometimes correct, and occasionally not so.

The human body is comfortable only when the heat extracted or lost to the body is equivalent to the heat it is generating. The rate the body gives off its heat is dependent on air movement, temperature and humidity.

The American Society of Heating and Ventilating Engineers and the Bureau of Mines have made an interesting study of comfort with varying temperature, humidity, and air movement conditions. A new standard is used in defining a comfortable temperature. It is called the Effective Temperature. We base our calculations on an effective temperature

(*Continued on Page* 85)

FUNDAMENTAL PHYSICAL DATA

Supplementing "Air Conditioning" by William Hull Stangle and Henry Warren Kingsbury

PHYSICS is defined as the science which treats of matter and energy. It is also defined as that branch of science which deals with the physical changes in matter of which the freezing and evaporation of water, the breaking up of substances and the like are examples.

Matter. Anything that occupies space is called matter. As an example, water is matter; when it freezes it is ice but still the same matter since there is only a physical change and there is no chemical change. By the same token water can be evaporated by heating to form a gaseous fluid called steam.

All matter is either a solid or a fluid. Fluids may be either liquid or gaseous. Solids have a definite volume and a definite shape. Liquids have a definite volume but take the shape of the containing vessel. Gases have neither a definite volume nor a definite shape; they not only take the shape of the containing vessel, but expand or fill the vessel irrespective of its volume. A liquid that flows freely is said to be mobile, while a sluggish liquid is said to be viscous.

Matter is indestructible, it can be changed physically or chemically and by proper treatment be brought back to its original state. This is called the law of conservation of matter.

All matter has certain specific properties. Since matter occupies space it must have volume, that is, it must have length, breadth and thickness. The fluids, liquids and gases also have volume but have the additional property of extension because of their fluidity.

Mass. The mass of a body is the measure of the quantity of matter it contains and does not vary.

Weight. The weight of a body may vary and is dependent upon two factors:

(a) The mass of matter it contains, and

(b) Its location on the earth's surface or its distance from the center of the earth. Weight is the measure of the earth's attraction for a body.

Impenetrability. When we pour a liquid into a container the air is forced out. This is true of all substances in general to the extent that no two objects can occupy the same place at the same time. This property is known as the law of impenetrability. When an insoluble, non-porous substance is placed in a liquid the liquid rises in a container and the total cubical content of the solid and liquid is equal to the sum of the volumes of the solid and liquid. The volume of the liquid displaced is equal to the volume of the solid.

Porosity. All matter is more or less porous and in practical work corrections must be made for the porosity. When sugar dissolves in water the sugar molecules actually enter into the voids between the molecules of water. This is known as solution and when the voids have been filled the solution is said to be saturated.

Inertia. Matter is inert when it is inactive. It is only affected by extraneous forces. This property of inertia establishes the law that bodies in motion tend to remain in motion while bodies at rest tend to remain at rest.

Tenacity. A body that is not easily pulled apart is said to be tenacious. The tenacity of any material or its tensile strength is measured by the force required to rupture its unit cross sectional area.

Ductility. A wire of steel, copper, aluminum or similar metal can be passed through a die, resulting in the reduction of the size of the wire, but an elongation results. The same mass is in the wire. This property of certain materials is known as ductility and refers to solids since liquids and gases are fluids.

Malleability. Certain metals may be hammered or rolled into thin sheets. This property is known as malleability. Gold is so malleable that it can be beaten into sheets so thin that 250,000 will make a pile 1 in. high.

Hardness. One material may be harder than the other. When two substances of unequal hardness are rubbed together the softer is worn away more rapidly unless the softer substance is travelling at a very high velocity. This property is indicated by what is termed as relative hardness.

Brittleness. A substance that is easily broken is said to be brittle. It should not be confused with hardness. Brittleness is the opposite to toughness, and substances are annealed to reduce their brittleness. Substances are tempered to procure proper hardness.

Measurement. The system of measurement used in the U. S. is the English system. The unit of length is the foot and this can be divided into 12 in. and the inches into halves, quarters, eighths, sixteenths, etc. There are 3 ft. to the yard and 5280 ft. to the mile. The unit of area is the square foot or square inch. There are 144 sq. in. to the square foot. The unit of volume is the cubic foot or the cubic inch. There are 1728 cu. in. in a cubic foot.

In practically all of the European countries, excepting Great Britain, the system of measurement is the metric system. The unit of the metric system is the meter, which is approximately 1/10,000,000th the distance from the equator to the pole. The unit of area in the metric system is the square meter. The unit of cubic measure is the cubic meter. The unit of volume is the liter. The unit of weight is the gram.

TABLE 1—LENGTH EQUIVALENTS

Centimeters	Inches	Feet	Yards	Meters
1	0.3937	0.03281	0.01094	0.01
2.540	1	0.08333	0.02778	0.0254
30.48	12	1	0.3333	0.3048
91.44	36	3	1	0.9144
100	39.37	3.281	1.0936	1
2012	792	66	22	20.12
100000	39370	3281	1093.6	1000
160935	63360	5280	1760	1609

TABLE 2—AREA EQUIVALENTS

Square Meters	Square Inches	Square Feet	Square Yards	Square Rods
1	1550	10.76	1.196	0.0395
0.0006452	1	0.006944	0.0007716	0.00002551
0.09290	144	1	0.1111	0.003673
0.8361	1296	9	1	0.03306
25.29	39204	272.25	30.25	1
404.7	627264	4356	484	16
1012	1568160	10890	1210	40
4047	6272640	43560	4840	160
2589998	.....	27878400	3097600	102400

TABLE 3—VOLUME AND CAPACITY EQUIVALENTS

Cubic Inches	Cubic Feet	Cubic Yards	U. S. Quarts		U. S. Gallons		Liters (1)
			Liquid	Dry	Liquid	Dry	
1	0.0005787	0.00002143	0.01732	0.01488	0.004329	0.003720	0.01639
1728	1	0.03704	29.92	25.71	7.481	6.429	28.32
46656	27	1	807.9	694.3	202.0	173.6	764.6
1.805	0.001044	0.00003868	0.03125	0.02686	0.007813	0.006714	0.02957
57.75	0.03342	0.001238	1	0.8594	0.25	0.2148	0.9464
67.20	0.03889	0.001440	1.164	1	0.2909	0.25	1.101
231	0.1337	0.004951	4	3.437	1	0.8594	3.785
268.8	0.1556	0.005761	4.655	4	1.164	1	4.405
2150	1.244	0.04609	37.24	32	9.309	8	35.24
61.02	0.03531	0.001308	1.057	0.9081	0.2642	0.2270	1

Fundamental Physical Data (*Continued*)

TABLE 4—MASS EQUIVALENTS

Kilograms	Grains	Ounces		Pounds		Tons		
		Troy and Apoth.	Avoir-dupois	Troy and Apoth.	Avoir-dupois	Short	Long	Metric
1	15432	32.15	35.27	2.6792	2.205	0.001102	0.0009842	0.001
0.00006480	1	0.002083	0.002286	0.0001736	0.0001429	0.00000007143	0.00000006378	0.00000006480
0.03110	480	1	1.09714	0.08333	0.06857	0.00003429	0.00003061	0.00003110
0.02835	437.5	0.9155	1	0.07595	0.0625	0.00003125	0.00002790	0.00002835
0.3732	5760	12	13.17	1	0.8229	0.0004114	0.0003673	0.0003732
0.4536	7000	14.58	16	1.215	1	0.0005	0.0004464	0.0004536
907.2	14000000	29167	32000	2431	2000	1	0.8929	0.9072
1016	15680000	32666	35840	2722	2240	1.12	1	1.016
1000	15432356	32151	35274	2679	2205	1.102	0.9842	1

Density. The weight of a unit volume of a substance is called its density. At 62° F., water weighs 62.355 lbs. per cu. ft. This unit is taken as a standard of unity and is the unit from which the specific gravity of all other substances is calculated. The specific gravity of gases, however, usually is calculated from a unit of hydrogen or air. If a given volume of a substance weighs twice that of a given volume of water, its specific gravity is 2. If a given volume of a substance weighs one-half that of a similar volume of water, its specific gravity is 0.5.

Force. Force is defined as a push or pull and usually is measured in grams or pounds. If the force is applied to a unit area it is called pressure. For example, a force of 1000 lbs. is applied to an area of 10 sq. in.; the pressure is said to be 100 lbs. per sq. in.

Energy. Energy has been defined as a capacity for doing work. It is not a substance and itself cannot be detected by any of the human senses but its manifestations in one of its forms when kinetic can be sensibly appreciated.

Energy, like matter, can neither be created nor destroyed but it can be transformed from one kind to another. The solar energy from ages past stored in the cells of huge trees was retained when in the carboniferous age coal was

TABLE 5—APPROXIMATE SPECIFIC GRAVITIES AND WEIGHTS

Substance	Specific Gravity	Average Weight, Pounds per Cu. Ft.
Metals, Alloys, Ores		
Aluminum, cast-hammered	2.55-2.80	165
Brass, cast-rolled	8.4-8.7	534
Bronze, phosphor	8.88	554
Copper, cast-rolled	8.8-9.0	556
Iron, gray cast	7.03-7.13	442
Iron, wrought	7.6-7.9	485
Mercury	13.6	849
Nickel	8.30-8.90	537
Steel, machine	7.80	487
Tin, cast-hammered	7.2-7.5	459
Various Solids		
Glass, common	2.40-2.80	162
Timber, U. S. Seasoned (Moisture, 15 to 20%)		
Cherry	0.70	44
Chestnut	0.66	41
Hemlock	0.42-0.52	29
Hickory	0.60-0.93	48
Maple, hard	0.68	43
Oak, white	0.74	46
Pine, white	0.41	26
Pine, yellow, long-leaf	0.70	44
Pine, yellow, short-leaf	0.61	38
Spruce, white, black	0.40-0.46	27
Walnut, black	0.64-0.70	42
Various Liquids		
Alcohol, ethyl (100%)	0.789	49
Alcohol, methyl (100%)	0.796	50
Water, 4° C., max. density	1.0	62.428
Water, 100° C.	0.9584	59.830
Water, ice	0.88-0.92	56
Water, snow, fresh fallen	0.125	8
Water, sea water	1.02-1.03	64
Ashlar Masonry		
Granite, syenite, gneiss	2.3-3.0	165
Limestone, marble	2.3-2.8	160
Sandstone, bluestone	2.1-2.4	140
Brick Masonry		
Pressed brick	2.2-2.3	140
Common brick	1.8-2.0	120
Soft brick	1.5-1.7	100
Concrete Masonry		
Cement, stone, sand	2.2-2.4	144
Cement, cinder, etc.	1.5-1.7	100
Various Building Materials		
Ashes, cinders	0.64-0.72	40-45
Cement, Portland, loose	1.44	90
Cement, Portland, set	2.7-3.2	183
Lime, gypsum, loose	0.85-1.00	53-64
Mortar, set	1.4-1.9	103
Earth, etc., Excavated		
Earth, dry, loose	1.2	76
Earth, dry, packed	1.5	95
Earth, moist, loose	1.3	78
Earth, moist, packed	1.6	96
Sand, gravel, dry, loose	1.4-1.7	90-105
Sand, gravel, dry, packed	1.6-1.9	100-120
Sand, gravel, wet	1.9	118-120
Bituminous Substances		
Coal, anthracite	1.4-1.8	97
Coal, bituminous	1.2-1.5	84
Coal, coke	1.0-1.4	75
Petroleum	0.87	54
Coal and Coke, Piled		
Coal, anthracite	0.75-0.93	47-58
Coal, bituminous, lignite	0.64-0.87	40-54
Coal, coke	0.37-0.51	23-32

Fundamental Physical Data (*Continued*)

formed. The coal can be burned under a boiler, the heat liberated converted into steam, and the steam used to drive an engine which in turn drives a generator to produce electricity. Thus the energy of the sun, stored in the coal, is converted into electrical energy.

formed. The coal can be burned under a boiler, the heat resulting producing in turn steam. The steam will activate a reciprocating or turbine engine producing mechanical energy. The machine will in turn move the rotor of a dynamo and produce electrical energy. The electrical energy can be carried by wires and will produce light, heat and power. During all these transformations the total amount of energy is constant and the fact that it may be transformed or transferred but cannot be destroyed is known as the law of the conservation of energy.

Work. Work is defined as a force that moves a resisting body in doing work.

The amount of work done is the product of the force times the distance through which it acts.

The gravitational unit in the English system is the foot-pound.

In all units of energy the intensity factor times the quantity factor is equal to the work done. In the foot-pound the number of feet traversed is the intensity factor and the number of pounds is the quantity factor. When an object is lifted vertically the work done is equal to the vertical height times the weight of the substance. This can be formulated wherein work equals force times the distance.

Power. Force is independent of distance and of time. Work is independent of time. Power, however, depends upon all three factors, i.e., force, distance and time.

Horsepower. The unit of power in the English system is known as horsepower and is equal to 550 ft.-lbs. per sec. or 33,000 ft.-lbs. per min.

In the metric system the unit of power is the watt or kilowatt (1000 watts).

A horsepower is equal to 746 watts, or about ¾ of a kilowatt.

Kinds of Energy. Energy is said to be either kinetic or potential. Potential energy is energy of position. It is energy in storage. Kinetic energy is the energy of motion, for a mass has kinetic energy due to its velocity. The one form of energy may be transformed into the other or vice versa.

Foot-Pound-Second. The unit of length in the foot-pound-second system is the foot, L. The unit of weight is the pound, W. The unit of time is the second, T. As there are 24 hrs. in the day, 60 minutes in the hour, and 60 seconds in the minute, there are 86,400 seconds per day. A second equals $\frac{1}{86,400}$ of the mean solar day. Time may also be expressed in minutes or hours.

Force of Gravitation. Gravitation is one of the most familiar natural forces known to mankind. Gravitation is universal. Bodies have mutual attraction. The force of mutual attraction is dependent upon two things: the masses of the bodies and the distance between their centers. It takes twice the force to lift 2 lbs. as it does to lift 1 lb. because the earth's attraction is twice as much for the larger mass. The force of attraction decreases as the square of the distance between their centers increases. Newton's law states "Every body in the universe attracts every other body with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between their centers."

Motion. Motion is a change of place or position. When an object moves in a straight line the motion is rectilinear. When it moves along a curved line it is curvilinear motion.

Velocity. Velocity is the rate of motion. It is the distance it moves in a given unit of time, and is expressed in miles per hour, feet per minute or second or if in the metric system, is expressed in kilometers per hour, etc. It commonly is referred to as speed.

Motion is uniform when there is a constant velocity. When the velocity is not constant the motion is variable.

Acceleration. An increase in velocity is called acceleration. A decrease is called deceleration. When the velocity increases in a constant ratio it is said to be uniform acceleration. The same is true of deceleration, or negative acceleration.

The velocity at the end of any second is equal to the distance the body would move during the next second, if at that instant it ceased to be accelerated.

When a body starts from rest and travels with uniformly accelerated motion, the acceleration equals twice the distance traversed during the first second.

If the acceleration is uniform, the velocity at the end of any second is directly proportional to the time. With the final velocity expressed as "v," acceleration as "a" and time as "t," thus $v = at$.

If the space passed over is "S" it is equal to the average velocity × time. The average velocity is equal to the sum of the initial velocity plus the final velocity divided by two. For a body starting at rest the initial velocity is zero, and the average velocity equals $\frac{0 + at}{2}$. Since s equals average velocity × time then

$$s = \frac{0 + at}{2} \times t = \frac{at^2}{2}$$

If the acceleration is constant, the distance traversed in any given number of seconds is equal to one half the acceleration multiplied by the square of the number of seconds. From this we derive the formula

$$v = \sqrt{2aS}$$

Further, the distance traversed in any given second may be determined by the formula $S = \frac{1}{2} a (2t - 1)$.

By reversal of the above formulae the deceleration or retarded motion can be calculated. This, however, will be discussed at greater length in a subsequent article.

Standard Gravitation. A freely-falling body will fall at a rate of acceleration of 32.174 ft. per second. This constant is designated by the symbol "g." Substituting for the previous formulae $v = gt$; $S = \frac{1}{2} gt^2$; $v = \sqrt{2gS}$; $S = \frac{1}{2} g (2t - 1)$.

According to an ancient scientist, Galileo, all bodies will fall at the same rate in a vacuum. Any noticeable difference is due to wind resistance and not to a variation in the law of standard gravitation.

Laws of Motion. The famous scientist, Sir Isaac Newton of the "falling apple" fame, formulated three fundamental laws of motion to explain why bodies move and deal with the relation between force and motion.

The first law states "Every body continues in its state of rest or uniform motion in a straight line unless it is compelled by some external force to change that state." It is the property of inertia.

The second law states "The rate of change of momentum is directly proportional to the acting force, and takes place in the direction in which the force acts." This law is a statement of what happens when a force acts upon matter, while the first law states what happens when forces do not act upon matter.

The third law states "To every action there is an equal and opposite reaction."

Fig. 1. Curvilinear Motion

Curvilinear Motion. From the first law above we find that a body which acquired velocity continues to move in a straight line. If a second force acts upon the body in motion at right angles to its path the line of travel of the body will deflect and the motion will become curvilinear.

Centripetal Force. The constant pull that deflects the body from the rectilinear path and compels it to move along the curve is termed centripetal force.

Centrifugal Force. If it were not for inertia the revolving body, of the preceding paragraph, would be pulled to the center. The reaction due to the inertia of the moving body offers resistance to the centripetal force or pull and tends to break the string. The resistance that a moving body offers to deflection from a straight line is known as the centrifugal force.

Fundamental Physical Data (*Continued*)

Friction. Friction opposes any force trying to produce motion. It is largely a function of adhesion.

Coefficient of Friction. The coefficient of friction is equal to the force needed to overcome friction divided by the weight. The coefficient of friction varies with the nature of the material and the degree of polish of the surface.

Pressures. Pressures are measured by means of gages. Gages indicate the differential between the pressure of the atmosphere and pressure being measured.

Atmospheric Pressure. At sea level the atmospheric pressure is given as 14.7 lbs. per sq. in. It is the pressure of the air envelope surrounding the earth and due to the force of gravity acting upon the molecules of the gases making up the atmosphere. This pressure decreases as higher altitudes, above sea level, are reached, and, as will be seen later affects the boiling point of liquids, of which the boiling point of water becomes of interest in this treatise.

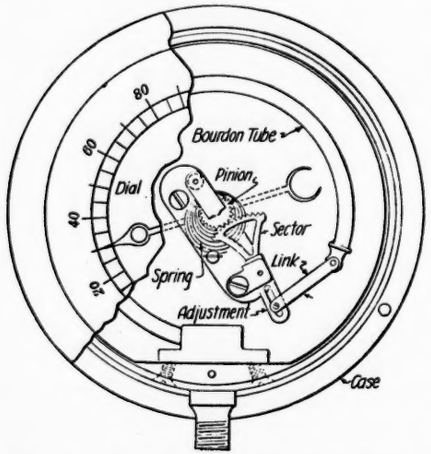

Fig. 2. Bourdon-Tube Pressure Gage

Gage Pressures. Pressures above the pressure of the atmosphere are registered by pressure gages and pressures below atmospheric pressure are registered by vacuum gages. There is no limit to the pressures that can be registered above atmospheric pressure but the vacuum gage can only register a vacuum equal to the atmospheric pressure or at sea level under normal conditions it will register a maximum of 14.7 lbs. per sq. in. vacuum. Vacuum gages are frequently calibrated to register in inches of mercury or water, as well as in pounds per square inch.

When relatively high pressures or vacuums are to be measured the spring pressure gages are used. When relatively low differentials are to be measured so-called draft gages are used.

Draft gages usually are U tubes containing water, alcohol, kerosene, or mercury and graduated to a scale reading either in inches of liquid or pounds or ounces per square inch.

When the registered pressure indicated by a pressure gage or draft gage is added to the atmospheric pressure the sum is denoted as the absolute pressure.

The Barometer. Atmospheric pressure usually is measured by a mercurial barometer. This consists of an inverted tube about 3 ft. long, closed at the upper end. It is filled with mercury and then inverted with the open end in a shallow mercury bath. Since there is practically no pressure on the closed upper end the mercury in the tube remains stationary since it is held in this position by the atmospheric pressure on the surface of the bath. As the pressure drops, due to atmospheric conditions, the mercury also drops and, likewise, as the pressure increases the mercury rises in the tube. Under normal conditions the pressure of one atmosphere, or 14.7 lbs. per sq. in., maintains the mercury at a height of about 30 in. It must be noted that the barometric pressure varies with atmospheric conditions and also with the altitude above or below sea-level.

Some engineers refer to pressures as so many atmospheres, meaning the number of pounds pressure divided by 14.7.

To obtain the pressure in pounds per square inch multiply the inches in mercury by 0.491. Conversely, a barometric pressure of $\frac{14.7}{0.491} = 29.92$ in. of mercury.

Draft Gage. In draft gages where the pressures to be measured are small, water is usually used because it weighs 1/13.6 the weight of mercury. It will be seen that for 1 in. of mercury there will be 13.6 in. of water, meaning that the accuracy will be 13.6 times as great, which, of course, is necessary when measuring more minute pressures. Since 0.491 in. of mercury equals a pressure of 1 lb. per sq. in. and the specific gravity of mercury equals 13.6, then $0.491 \times 13.6 = 7.6776$ in. of water equals a pressure of 1 lb. per sq. in. and the reciprocal $1/7.6776 = 0.13025$ lbs. per sq. in. per inch of water.

Fig. 4. Inclined Draft Gage

Static pressure is the pressure required to maintain a differential between two points in a system. It is akin to the pressure drop, or is the pressure required to offset or equal a pressure drop. Velocity pressure is the pressure required to produce a given velocity. By dynamic pressure is meant the sum of the static pressure and the velocity pressure.

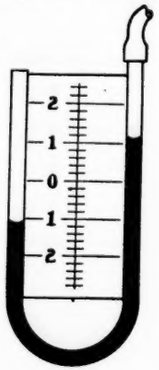

Fig. 5. U-Tube Draft Gage

Heat. Heat is energy. Since energy is the product of the quantity factor times the intensity factor heat must be the product of these two factors. In heat the quantity factor is the specific heat of the substance and the intensity factor is the temperature differential.

Thermometry. The intensity factor of heat is measured in degrees of temperature. Three scales are in general use. The popular scale in America is the Fahrenheit scale. In scientific work here and in Europe in general the Centigrade scale is generally used.

The Reamur scale is not used generally in the practice of ventilation or air conditioning.

All of these scales are calibrated in definite degrees between the freezing point and boiling point of water. The Fahrenheit scale is divided into 180°, the Centigrade into 100°, and the Reamur into 80°. The Centigrade scale fixes 0° at the freezing point and 100° at the boiling point. The Fahrenheit scale fixes 32° as the freezing point and 212° as the boiling point with the 0° point at 32° below the freezing point.

Since these scales clearly are indicative of the sensible heat limits of water in the liquid state, they might well be termed liquid-phase thermometers, using water as the standard at sea level.

To convert readings from Fahrenheit to Centigrade, or vice versa, substitute either of the following formulae:

$$C° = 5/9\ (F° - 32) \qquad F° = (C° \times \tfrac{9}{5}) + 32°$$

Absolute Zero. Now, it is a fact that many substances are still liquids or gases when water has reached the frozen state. But, at lower temperatures these substances become frozen or are liquefied. Naturally, there must be a limit, i.e., when the molecular

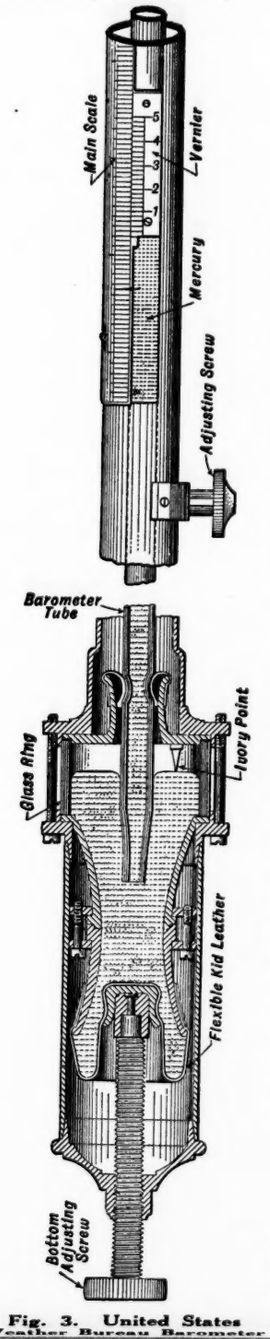

Fig. 3. United States Weather Bureau Barometer

Fundamental Physical Data (*Continued*)

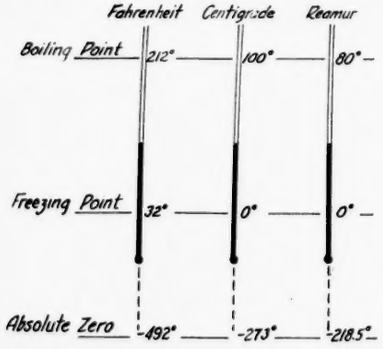

Fig. 6. Comparison of Thermometers

vibrations that produce heat cease. This temperature has been established as 491.6° F. below the melting point of ice (32° F.), or 459.6° F. below 0° F. On the Centigrade scale absolute zero is 273° below 0° and on the Reamur scale it is 218.5° below 0°.

Absolute Temperature. To find the absolute temperature in Fahrenheit add the thermometer reading to the absolute zero 459.6°; for the Centigrade add the temperature reading to 273°, and for the Reamur add the temperature reading to 218.5°.

Another method of measuring temperatures is by the use of pyrometers, which will be discussed later in this article.

B. T. U. Probably, the most important unit that will be used in this treatise is the British Thermal Unit, the B.T.U. It is defined as the amount of heat required to raise 1 lb. of water at its maximum density 1° F. It is a unit of energy, being the product of the quantity factor and the intensity factor. The quantity factor is the specific heat of water (1) and the intensity factor is the temperature differential, which is 1° F. It is to be noted that the time factor is not involved and that to express the unit of power it must be stated as B.T.U. per hour.

Specific Heat. The "specific heat" of a substance is the amount of heat energy required to raise 1 lb. of the substance 1° F. It is kindred to the above description of the B.T.U. and is expressed in B.T.U. This is clearly indicated in the fact that the specific heat of water is 1.

TABLE 6—SPECIFIC HEATS OF VARIOUS SUBSTANCES

SOLIDS

Temperature Range °F.	Material	Specific Heat
59-460	Copper	0.095
59-212	Wrought iron	0.115
68-212	Cast iron	0.118
68-208	Steel (soft)	0.117
68-208	Steel (hard)	0.116
66-212	Glass	0.198
.....	Ice	0.504

LIQUIDS

59	Water	1.000
32	Alcohol	0.547
176	Alcohol	0.769
32	Mercury	0.334
64	Sea-water (sp. gr. 1.0043)	0.980
64	Sea-water (sp. gr. 1.0463)	0.903
64-210	Petroleum	0.498

GASES

Temperature Range °F.	Material	Specific Heat at Constant Pressure	Specific Heat at Constant Volume
32-392	Air	0.237	0.169
55-405	Oxygen	0.217	0.155
32-392	Nitrogen	0.243	0.172
54-388	Hydrogen	3.409	2.414

GASES—(*Continued*)

Temperature Range °F	Material	Specific Heat at Constant Pressure	Specific Heat at Constant Volume
41-208	Carbon monoxide	0.242	0.172
52-417	Carbon dioxide	0.216	0.153
64-406	Methane	0.592	0.450
.....	Blast-furnace gas (approx.)	0.227	.....
.....	Flue gas (approx.)	0.240	.....

SPECIFIC HEAT OF BUILDING MATERIALS

Specific Heat	Material
0.195	Brick work
0.215	Masonry
0.200	Plaster
0.467	Pinewood
0.570	Oakwood
0.480	Birch
0.197	Glass

Electrical Units. Since energy cannot be destroyed and cannot be diminished or increased, and can be changed from one form to another, it stands that heat energy can be changed to electrical or mechanical energy. The mechanical system has been described as to units. The electrical units follow for the purpose of more clearly understanding pyrometry (the measurement of the higher temperatures) and later the utilizing of the electric current as a heating agent.

TABLE 7—ELECTRICAL AND MECHANICAL EQUIVALENTS

1 KILOWATT HOUR =
1000 watt hours
1.34 H.P. hours
2,654,200 ft. lb.
3,600,000 joules
3,414.5 B.T.U.
367,100 kilogram meters
0.235 lb. carbon oxidized with perfect efficiency
3.53 lb. water evaporated from and at 212° F.
22.75 lb. of water raised from 62° to 212° F.

1 H.P. HOUR =
0.746 kw. hours
1,980,000 ft. lb.
2,546 B.T.U.
273,750 kg. m.
0.175 lb. carbon oxidized with perfect efficiency
2.64 lb. water evaporated from and at 212° F.
17.0 lb. water raised from 62° F. to 212° F.

1 KILOWATT =
1000 watts
1.34 horsepower
2,654,200 ft. lb. per hour
44,240 ft. lb. per minute
737.6 ft. lb. per second
3,414.5 B.T.U. per hour
56.9 B.T.U. per minute
0.948 B.T.U. per second
0.2275 lb. carbon oxidized per hour
3.53 lb. water evaporated per hour from and at 212° F.

(Table continued on following page)

(Table continued from preceding page)

1 HORSEPOWER =
746 watts
0.746 kw.
33,000 ft. lb. per minute
550 ft. lb. per second
2,546 B.T.U. per hour
42.4 B.T.U. per minute
0.707 B.T.U. per second
0.175 lb. carbon oxidized per hour
2.64 lb. of water evaporated per hour from and at 212° F.

Watt. The electrical unit of energy is the "Watt" = P. It is the product of the intensity factor, the volt = E, and the quantity factor, the ampere = I. Thus P = EI.

Kilo Watt. As the watt is a very small unit, it is generally referred to in units of 1000, i.e., the kilowatt, meaning one thousand watts.

K. W. H. The unit of power is the kilowatt-hour = KWH and usually indicated by W.

Volt. The volt is the practical unit of electromotive force. It is the intensity factor.

Ampere. The ampere is the current that will flow through a conductor having a resistance of 1 ohm and difference of potential of 1 volt between the ends of the conductor. It is the quantity factor.

Ohm. The "ohm" is the unit of resistance and is defined as the resistance through which the fall of potential is 1 volt when the current strength is 1 ampere. "Conductance" is the reciprocal of resistance, i.e., 1/ resistance.

Sources of Electrical Energy. There are several sources of electricity, principal of which are static, magnetic, and chemical. Static electricity is produced by friction. Magnetic electricity is produced by cutting the lines of force of a magnetic field. Chemical electricity is produced by the giving up of electrical ions by a chemical in undergoing a chemical change.

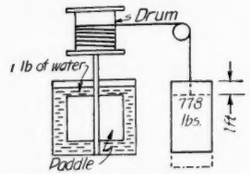

Fig. 7. Mechanical Equivalent of Heat: 778 Ft.-Lbs. Raises 1 Lb. of Water 1° in Temperature

Mechanical and Electrical Equivalents. Since all forms of energy are mutually convertible there is a definite numerical relation between these units of energy. The table of equivalent values of electrical and mechanical units clearly shows these relations.

Pyrometry. When high temperatures are to be measured pyrometers are used. Mercurial pyrometers may be used up to 1000° F. As mercury boils at 676° F. an inert gas such as nitrogen or carbon dioxide is forced into the tube above the mercury under pressure. The boiling point of liquids can be raised by placing the liquid under pressure. Inert gases instead of air (containing oxygen) are used to prevent oxidation.

Ordinary mercurial thermometers are used for temperatures under 400° F. Expansion pyrometers are used for temperatures up to 1500° F. They are made of two different metals, each with a different coefficient of expansion. The differential is calibrated to read in degrees.

The thermo-electric pyrometers are most frequently used. They are made with two wires of different metals. One end is placed in the heated area and the other in a cooler area, forming a thermo-couple. An electromotive force is set up due to the temperature differential. The force actuates a galvanometer of high resistance. The galvanometer deflection can be calibrated to give very accurate readings of temperatures.

For temperatures up to 3600° F. the radiation pyrometer may be used and optical pyrometers will indicate temperatures up to 12,000° F.

Calorimetry. Heat may be measured by the use of calorimeters. The unit used is the British Thermal Unit, B.T.U. The calorimeter is an apparatus in which a hot substance of known weight and temperature is introduced and in cooling will in time increase the temperature of another substance, usually a liquid, of known weight and known initial temperature. By calculation from the data found, the heat content of the introduced substance can be determined. This is the method employed in determining the specific heat of a substance.

Expansion of Solids. Practically all substances expand, i.e., increase in length, area or volume, when heated, provided there is no change in state.

The amount by which a unit of a substance changes per 1° rise temperature is called the coefficient of expansion. The change in length is called linear expansion, the change in area is called superficial expansion and the change in volume is called cubical expansion.

The coefficient of expansion is not constant; therefore the temperature range should always be considered.

TABLE 8—LINEAL EXPANSION OF SOLIDS (PER FOOT PER DEGREE INCREASE IN TEMPERATURE, FAHRENHEIT)

Substance	Temperature Conditions, Degrees, F.	Coefficient per 100 Degrees, F.
Brass (cast)	32 to 212	0.00001042
Copper	32 to 212	0.00000926
Glass (English flint)	32 to 212	0.00000451
Granite (average)	32 to 212	0.00000482
Iron (cast)	104	0.00000589
Mercury	32 to 212	0.00009984
Steel (Bessemer rolled, hard)	0 to 212	0.0000056

Propagation of Heat. Heat can be propagated (spread) by conduction, convection and radiation.

Conductivity. Conductivity is the molecular transmission of heat. It is the transmission of heat from particle to particle of a substance, the heat "flowing from the particle of higher temperature to the particle of lower temperature until both are at the same temperature." Since all substances are not alike the conductivity of materials varies. It takes time for the heat to pass from one particle to another. Substances that conduct heat rapidly are called good conductors. When they conduct heat slowly they are called poor conductors. Good conductors are used where heat is to be transmitted. Poor conductors are used as insulators against the loss of heat.

Conduction may take place in any direction from the source of heat. It does not travel in a straight line like radiation, which will be described later.

The coefficient of conductivity is the quantity of heat which flows in unit time, through a unit cross section area, with a unit thickness and with a temperature differential of 1°.

Formulated in the English system the equation is

$$Q = CS \frac{(t_2 - t_1)}{X} T$$

wherein Q = quantity of heat in B.T.U. C = coefficient of conduction per 1 in. in thickness. S = area in square feet, $t_2 - t_1$ = temperature differential, X = thickness in inches and T = time in hours.

Convection. Convection is the transmission of heat by the circulation of a fluid, a liquid or a gas over the surface of a body. The molecules or particles of the fluid come into close contact with the body to be heated or cooled and are cooled if heating a colder body or heated if cooling a hotter body. When the fluid is hot and the substance passed over is cooler, the substance is heated and the fluid cooled. Vice versa, if the fluid is cold and the substance is hot the fluid is heated and the substance is cooled.

The heat transferred by convection is independent of the nature of the surface of the body and of the surrounding absolute temperature.

Fundamental Physical Data (*Continued*)

Formulated in the English system the equation is

$$H = f\ (V)^{\frac{1}{n}} (t_s - t_a)\ A$$

wherein H = heat given *off* in B.T.U., f = constant determined by the radiator in question, V = velocity in feet per second, $t_s - t_a$ = temperatures of the heating media and outside air respectively in degrees F. and A is the area in square feet.

Radiation. Radiation is the transmission of heat through that medium which is called ether (an unknown something which is supposed to fill the voids between all molecules).

Radiation always acts in a straight line, similar to light rays. The intensity per unit of surface varies inversely as the quare of the distance from the source of radiation to the surface of the body being heated. Radiation continues in a straight line until intercepted or completely absorbed by another body.

Unlike convected heat, radiant heat is dependent upon the character of the surface of the substance. Further, it has been found that the power of a substance for radiant heat is the same as for emitting radiant heat.

TABLE 9—RELATIVE RADIATING OR ABSORBING POWER AT 212° F.

Lampblack	100
White lead	100
Paper	98
Glass	90
India ink	85
Shellac	72
Steel	17
Platinum	17
Polished brass	7
Copper	7
Polished gold	3
Polished silver	3

Radiant heat passes through dry gases without appreciably heating them. On the other hand air containing water vapor or dust will absorb radiant heat. This may be due to the fact that the water or dust particles occupy some of the voids between the molecules of air.

Heat emitted by radiation per unit of surface and per unit of time is independent of the form and extent of the heated body.

The formula expressing the amount of heat given off by radiation is

$$H = K\ (T_1^x - T_2^x)$$

wherein H = heat given off in B.T.U. K the radiation coefficient and $T_1 - T_2$ the *absolute* temperatures of the hot body, and the colder body or bodies. The exponent x has been given the value of 4.

(To be continued)

Air Conditioning
(Continued from Page 78)

of 67° which is equivalent to 70° dry bulb and 60° wet bulb, a too high humidity. A temperature of 72° dry bulb and 57° wet bulb, which has the same effect, is to be preferred.

In summer the temperature inside should not be lower than 10° below that outside. Comfort in summer is comparative and is varied by the amount of clothing worn and other conditions. A maximum temperature of 85° with a relative humidity of 50% is commonly assumed. This summer comfort zone will be discussed in further detail.

World Production of Coal Increased in 1929

The world production of coal of all grades in 1929 was 1,540,000,000 metric tons, representing a gain of 6.2% over 1928, according to preliminary figures compiled by the United States Bureau of Mines, Department of Commerce. Of the 1929 production, 229,000,000 tons, or about 15% of the total, was lignite and 1,311,000,000 tons was bituminous coal and anthracite. In comparison with 1928, the output of lignite increased 5.5% and the production of bituminous coal and anthracite 6.8%.

The United States, as usual, was the largest producer, its total output being 552,465,000 metric tons, of which 69,526,000 tons was anthracite and 482,939,000 tons was bituminous and lignite. The second largest producing country was Germany, credited with a total output of 332,156,988 tons; of this, 163,437,056 tons was bituminous and 175,177,932 tons was lignite.

Bureau of Standards Studies Effect of Smoke and Fumes

Extensive evidence of the damage done to building stone, metals and vegetation by air polluted as the result of fuel combustion has been gathered in a recent study conducted by the Bureau of Standards, Department of Commerce, according to a statement issued by the department. The statement follows:

A survey of the literature on atmospheric pollution has been completed by the paper section, Bureau of Standards. No new ideas have been brought to light, but the importance of a knowledge of smoke and fume effects has been intensified. This study very sharply emphasizes these facts: Atmospheric sulphur dioxide, resulting from the combustion of fuels, is ultimately changed to sulphuric acid, unquestionably a very destructive agent. Deteriorative action of this sulphuric acid upon building-stone, metals and vegetation is strongly emphasized, and a like action on papers is to be expected.

In this, statistics from fifteen American and European cities were compared. These showed air-pollutions ranging from 0.20 to 3.00 parts of atmospheric sulphur dioxide per million parts of air, and an annual precipitation (same as rainfall) of sulphuric acid averaging from 11 to 190 tons per square mile.

Estimating and Designing Heating Systems

IX—Effect of Enclosures and Painting on Radiator Heat Emission

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REDUCTION in the amount of radiant heat is also noticeable when radiators are enclosed. The general effect of enclosing a radiator is to reduce the heat emission, unless the casing is made sufficiently high to create a stack effect, thus increasing the air movement, and therefore the K value sufficiently so as to overcome the radiant heat loss. With a properly-designed enclosure, even though it be low so that the heat emission is less than when the radiator is exposed, better heat distribution often results with the breathing-line temperature maintained at 70°, a higher temperature near the floor, and a lower ceiling temperature.

Many interesting experiments have been made and are being made on the effect of enclosures, but the combinations are so varied as to preclude a detailed discussion in this article. A set of rules that should be followed in their design are given herewith as taken from the 1930 A.S.H.V.E. *Guide*.

Rules for Designing Radiator (Conductor) Enclosures

1. Enclosure should be insulated with 1-in. magnesia or asbestos block, lined with bright tin or non-corrosive sheet metal, placed next to the conductor.

2. The surface of the conductor should be painted flat black, maroon japan, white enamel or white zinc. If the radiator (conductor) is entirely concealed it may be unpainted.

3. The free area of the grille or opening at the outlet should be not less than the free area through the sections of the conductor.

4. The free area of the grille or opening at the inlet should be not less than 80% of the free area at the outlet.

5. If the outlet is in the face of the enclosure so that the air flow is horizontal, the free area of the outlet should be at least 150% of the free area about the conductor, and the clear height between the top of the conductor and the underside of the top of the enclosure should be not less than the depth of the enclosure.

6. Best results are obtained with a tight-fitting enclosure, provided the free area about the conductor at the point of greatest restriction is not excessive. As a general rule, the efficiency of the radiator (conductor) is inversely proportional to the depth of the enclosure.

Table 11 is also taken from the Guide to show the effect of painting a radiator.

TABLE 11

Effect of Painting a 32-in. Three-column Six-section Cast-iron Radiator

Test Number	Finish	K
1	Bare iron—foundry finish	1.77
2	One coat of aluminum bronze	1.60
3	Gray paint, dipped	1.78
4	One coat dull black Pecora paint	1.76

Only the radiant heat is affected by the painting so that the effect is more marked on pipe coils or on radiators with few tubes or columns. As it is a surface effect only, the thickness or number of coats will make no difference and the color and nature of the last coat, only, is a factor. It is of interest that the paint most used in our decorative color schemes, metallic bronze, gives the lowest efficiency.

Types of Radiators (Conductors)

In times past the radiators most generally used were of the cast-iron or pressed-steel column type. The number of square feet of surface for the varying heights and sections was given by the different manufacturers, but the equipment was so nearly standardized that the same value could be applied to all makes. The values thus lent themselves to the formation of an approximate rule to determine the surface area. This rule was that the square feet of radiating surface was obtained by multiplying the column height of the radiator in inches by the number of columns and dividing by 20.

Thus, deducting 4½ in. for the legs from a 38-in. radiator, the column height is 33.5 in., and for a 3-col., 38 in. radiator the radiating surface is

$$\frac{3 \times 33.5}{20} = 5.03 \text{ sq. ft.}$$

as compared with 5.0 sq. ft. given in Table 12.

TABLE 12

Heating Surface per Section of Cast-iron and Pressed-steel Radiators

Cast-Iron Height In.	One column	Two column	Three column	Four column	Six col. window pattern
45	...	5	6	10	
38	3	4	5	8	
32	2 1/2	3 1/3	4 1/2	6 1/2	
26	2	2 2/3	3 3/4	5	
23	1 2/3	2 1/3	...	...	
22	...	2 1/4	3	4	
20	1 1/2	2	...	...	5
18	...	...	2 1/4	3	...
16	...	...	...	...	3 3/4
15	...	1 1/2	...	...	...
13	...	...	...	...	3
Pressed Steel					
38	3	...	5	...	
32	2 1/2	...	4 1/2	...	
26	2	...	3 3/4	4 1/2	
22	1 2/3	...	3	3 3/4	
18	1 1/3	...	2 1/4	3	
14	1	...	1 1/2	2 1/4	

To find the value of K for the various heights and columns probably the most concise method is by means of the chart, Fig. 27. Values obtained from these curves are exactly those obtained from later test results with steam at 215° and a room temperature of 70°. Thus the value of K for a 38-in., 2-col. radiator for standard conditions taken from the chart is 1.65, while for a 32-in., 4-col. it is 1.5, etc.

If these radiators were to be used for hot-water with the average water temperature at 170° the temperature difference would be (170° — 70°) = 100° or 45° less than standard conditions and a correction of 0.2% must be made for each degree departure from standard conditions, or 0.002 x 45 = 0.09 or 9%. The value of K then for the 38-in. 2-col. radiator for hot water heating will be 0.91 x 1.65 = 1.5 B.T.U., and for the 32-in. 4-col. it will be 0.91 x 1.5 = 1.365 B.T.U.

Tubular-Type Radiators (Conductors)

In principle these are similar to the older-type radiators except that the smaller tubes have supplanted the larger columns, resulting in a neater and lighter appearance. The surface areas as given in the catalogs of the manufacturers for the various heights and sections are not the actual areas but the equivalent area based on an emission value of 240 B.T.U. per sq. ft.

TABLE 13

Tubular Radiators—Radiating Surface in Sq. Ft. per Section

No. of Tubes	Height in Inches				
	37	32	25	21	14
3	3	2 1/2	2	1 1/2	...
4	4	3 1/3	2 1/2	2	...
5	5 1/8	4 1/4	3 1/4	2 1/2	...
6	6	5	3 3/4	3	2

Thus, a section having an actual surface of 3¼ sq. ft. may be found upon test to have only a total emission of 720 B.T.U., it would then be rated as having a heating surface of

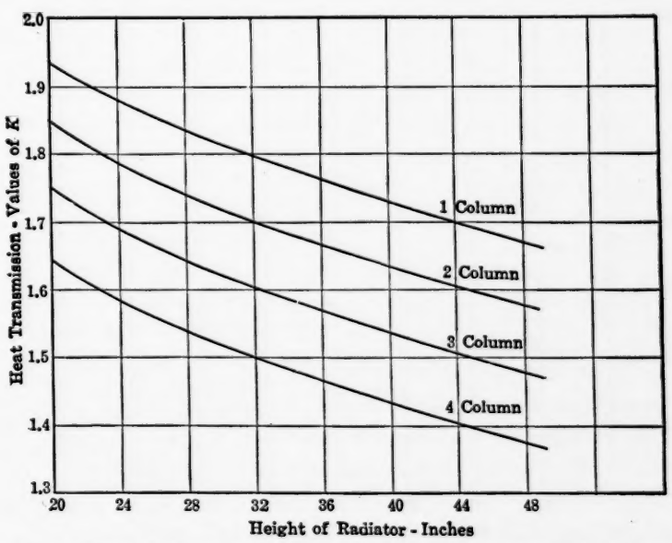
$$\frac{720}{240} = 3 \text{ sq. ft.}$$

While the accepted standard for steam heating is 240 B.T.U. per sq. ft., that for hot water is not quite so firmly fixed, but 160 B.T.U. seems most generally taken. In rating their tubular radiators many of the manufacturers state that the given area is for either steam or hot water and in others it seems to be implied that this is so. From the example just discussed it can be seen that this cannot strictly be the case, that only about 91% efficiency may be expected with water as compared to steam so that it becomes necessary to use but 91% of the tabulated area in our estimation or, which amounts to the same things, use an emission value of 91% of 160°.

Table 13 gives the equivalent rated surface of tubular radiators as taken from one manufacturer's catalog.

Values in Table 13 are given for illustration and are not to be used for all makes of this type of radiator as the rated surface varies with different makes.

There are many new and worthy radiators now appearing on the market made of material other than iron, termed the non-ferrous type.



From Allen & Walker's "Heating and Ventilation," McGraw-Hill Book Co.

Fig. 27. Coefficient of Heat Transmission from Radiators

Through extended surfaces and other principles of design they attain a slightly higher emission value per square foot of actual surface and many of them meet with much favor due to the conservation of space. The advantage of others is in better heat distribution. All of these are rated by the equivalent radiation area method.

To illustrate the application of the principles involved in estimating radiation let us take a room with a heat loss of 14,000 B.T.U., to be heated with steam at 215° and the room temperature to be maintained at 70°. If possible, we wish to use a 2 col., 26-in. cast-iron radiator. From Fig. 27 we find the value of K for this size to be 1.76 B.T.U. and the emission per square foot will be 1.76 x 145 = 255 B.T.U. Therefore it will require

$$\frac{14000}{255} = 55 \text{ sq. ft. of radiation.}$$

From Table 12 we find that there are 2-2/3 sq. ft. of radiation in a section of this size and our radiator must then have

$$\frac{55}{2\text{-}2/3} = 21 \text{ sections.}$$

Should we desire to use a 6-tube, 25-in. radiator we find from Table 13 that a section of this size contains 3¾ sq. ft. of equivalent radiation. One section, therefore, will have an emission value of 3¾ x 240 = 900 B.T.U., and we would need

$$\frac{14000}{900} = 16 \text{ sections.}$$

Should we desire to heat the room with pipe coils we would again use the coefficient K in our estimate. This for a single horizontal pipe is 2.65, for a coil four pipes high it is 2.48 and for one nine pipes high it is 2.12 B.T.U. Adopting the type 9 coils high we find the emission to be 2.12 x 145 = 307 B.T.U., and sufficient length of pipe must be used to give

$$\frac{14000}{307} = 45 \text{ sq. ft. of outside area.}$$

If the room is to be heated with hot water, from a former calculation we found that the value of K will be but 91% of its value under standard conditions. In the case of the 2-col., 26-in. radiator, the value of K will then be 1.76 x 0.91 = 1.60 B.T.U., and as the temperature difference is but 100° the emission per square foot is 1.60 x 100 = 160 B.T.U., calling for 88 sq. ft. of heating surface, or 33 sections.

This is an increase in the heating surface of 60% and a general rule can be formulated that the heating surface for steam must be multiplied by the factor 1.6 for hot water under standard conditions. In the case of the tubular radiator where 16 sections were needed for steam it would take 16 x 1.6 = 26 sections when water is the heating medium. The pipe coils must be increased to 45 x 1.6 = 72 sq. ft. of heating surface. When pipe coils are used in gravity water systems they should have manifold fittings, as the return bends create excessive friction.

(To be continued)

Smoke from Heating Plants Reduced in Salt Lake City Campaign

ONE of the most enlightened smoke abatement campaigns that has been waged in this country is that conducted for the past several years in Salt Lake City, Utah, according to the United States Bureau of Mines, Department of Commerce. The campaign was inaugurated by the municipal authorities in cooperation with the Bureau of Mines and the University of Utah in 1919, and the result has been to reduce at least 90% of the smoke from large industrial and heating plants.

A survey conducted during the winter months of 1919 and 1920, showed that industrial and large heating plants were responsible for 44.58% of the smoke; residences for 21.83%; railroads for 18.38%; small heating plants 9.04%, and miscellaneous consumers 6.17%.

Smoke produced by large heating and industrial plants in the business district of the city was found to be the real problem. The survey indicated that most of these plants were producing 35% as much smoke as it was possible for them to produce; the fact that in 1930 the plants produced less than 2% of the possible volume of smoke shows what can be accomplished.

A study was made of the domestic heating problem. Methods of firing were studied and it was found to be entirely possible to reduce smoke from this class of equipment to a low minimum. Methods of starting fires were emphasized and instructions to domestic-furnace operators formulated.

New residence equipment was included. The controllable factors of this class are primarily concerned with draft. Chimney size and construction are specified, as well as position of furnace with respect to chimney. The furnace chimney must be independent and free from all other connections, such as water-heaters, stoves, and the like.

Conclusions drawn by the Bureau of Mines regarding the smoke abatement campaign in Salt Lake City are that:

Smoke from large industrial and heating plants has been reduced at least 90%. This reduction was effected by cooperative methods in improving plants and instructing firemen, and through a system of rigid inspection and control.

An observation tower is effective in a smoke-abatement campaign.

Small heating plants, heretofore neglected in similar smoke-abatement campaigns, can successfully be converted into smokeless types at small cost. Every plant in the business and industrial section of the city is now in condition to operate within the smoke ordinance.

Railroad locomotives now contribute little to the smoke nuisance. Cinder fall in the railroad district is still high, and its elimination is a problem.

With present equipment and the present smoke ordinance and organization, the smoke from all plants, except residences, can be kept low enough not to create a smoke cloud.

After 10 years of activity in smoke abatement, and in spite of the substantial reduction effected, the smoke problem in Salt Lake City has not yet been completely solved.

Credit Control and Trade Practice Rules Features of Heating and Piping Contractors Convention

TRADE Practice Rules submitted to the Heating and Piping Contractors National Association convention, held at The New Yorker Hotel, New York, June 16-19, were approved by the convention and a resolution passed to the effect that a committee be appointed to work with the National Association of Master Plumbers in submitting the rules to the Federal Trade Commission. Discussion of these rules, together with a growing interest in credit control manifested at the convention, were outstanding among the proceedings of the meeting, which was the 41st annual convention of the organization.

Interest was not confined to merchandising alone. Appreciation of the work of the committees on engineering standards, welding, and boiler output was particularly keen. Advantages and disadvantages of the quantity survey bureau drew forth considerable discussion. Among the comments on the survey of the heating industry, by Joseph C. Fitts, were the suggestions by members that it be further broken down and that the survey be continued.

Following the resignation of Henry B. Gombers, who has been secretary of the association for thirty-three years, Joseph C. Fitts, assistant secretary, was appointed to serve as secretary. The title of secretary emeritus was bestowed on Mr. Gombers.

Afternoon Session, June 16

At this session the address of welcome was made by a representative of Mayor James J. Walker of New York. This was followed by the introduction of the past presidents, including P. Gormly, John T. Bradley, J. E. Rutzler, N. Loring Danforth, Frank A. Merrill and Harry M. Hart.

In his address, President Walter Klie stated that:

The very unsatisfactory conditions of business and of employment today are the challenge which is provoking thorough and intelligent examination and analysis of our political and economic policies.

President Walter Klie

Re-elected president of the H. & P.C.N.A. for the third consecutive term

Business leaders are realizing and asserting, as never before, some basic truths, to wit:

That the prosperity of our country is directly proportionate to the purchasing power of the masses, and that this purchasing power is dependent upon employment at wages with a margin over bare living wages. Consequently, the usual stampede to cut wages to the minimum at the first sign of distress has become recognized as unwise and unpopular.

That the creating of as much employment as possible is an obligation and an act of wisdom.

That the dollar spent in construction work reaches more people than a dollar spent anywhere else, and consequently any money which can now be spent for contemplated improvements, rehabilitation, rejuvenation and modernization, will not only be economically spent, but will hasten the return of prosperity.

That the capital available for home building is inadequate, and that the organization of that part of our credit supply system must be as thoroughly perfected as it is in the commercial field, so as to provide a more steady flow of capital to the home builder.

That building business on the basis of volume alone, with the resultant fight to get such an unreasonable share of the consumer's dollar for one industry that other industries must suffer, is unsound, and the resultant inadequacy of the consumer's dollar will bring distress to all.

That business built on the basis of quality, efficiency, stability and profit, possible under normal volume expectancy, is preferable and sounder than business dependent for its success, upon abnormal temporary volume, produced by exceedingly high-pressure methods.

That intelligent planning of the future is largely dependent upon the gathering and disseminating of facts pertaining to an industry, by the trade association of that industry, and the intelligent application of these facts by the individual units of each industry.

We believe our Heating and Piping Contractors National Association, within the limit of its financial resources, has been doing an outstanding job gathering and disseminating pertinent facts regarding our industry, and is organized to do an increasingly adequate job in this line.

Let us review some of the weaknesses of the position we find ourselves in as Heating and Piping Contractors and set up against them some of the more helpful influences which we should encourage.

The first thing that will naturally occur to us as the reason for lack of profits is the lack of business. The building of new homes and buildings of all types has, of course, a direct relationship to the increase in population and obsolescence, so that if we are building at a rate below such requirement for a period, we are accumulating a deficiency which will result in better building periods to come, just as the abnormal rate we have indulged in during some periods in the past reflected itself in periods of depression.

Authorities generally agree that we are building up a deficiency which promises better volume in the near future.

In the meantime the needs of the

present situation have brought to our attention more clearly the great field in modernization. National campaigns are being conducted, and many locals tying in with them. Cooperative advertising campaigns and sales schools for contractors are being conducted, all efforts in the right direction, which will have their influence on our industry for years to come.

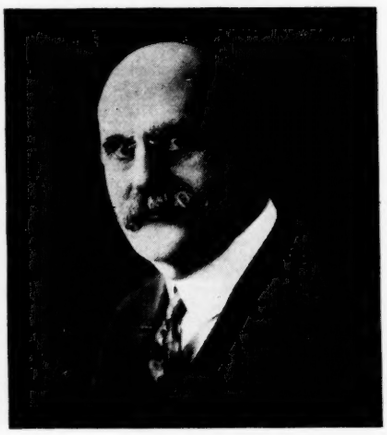
Another fact that has been definitely established is that there is no sound basis for believing that you or I will ever see a time in our industry when there will be so much business that money will be automatically made by the large mass of contractors without intelligent businesslike operation of their businesses. It is increasingly necessary in this close competition for contractors to know and respect their labor and material cost and their overhead.

Credit Bureaus in our branch of the building industry, and in the industry as a whole, are being established, so that the contractors eventually must figure at least their labor and material and overhead cost or put themselves out of business. Every contractor who is seriously in this business must recognize this as the greatest single agency toward curing the present below cost bidding, and should immediately see the wisdom of encouraging and cooperating with the supply people in every legitimate manner.

We must help build these Credit Bureaus on such a high and broad plane, without mixing any selfish object into them, that all the elements in the community will be impressed with their soundness of purpose.

President Klie's address was followed by the appointment of various convention committees, after which John C. Howell delivered an address entitled "What is Ahead of the Heating and Piping Contractor?" Mr. Howell reviewed business conditions since 1914, and told how the country was headed for a depression at the beginning of the war. This was averted due to the tremendous demand for goods by the warring nations. He told how business conditions maintained at a high level following the war and explained that the year 1929 marked the end of a cycle and that now we are at the beginning of a long period of what might be termed normalcy. Building cannot continue at the rate it maintained during the period just passed and the contractor must expect to devote a considerably larger part of his time to modernizing.

After outlining the many rather discouraging reasons why business will not continue to be what it has been, he mentioned the factors which will tend to cause business to increase. Among these were the fact that every year the increase in population is in numbers equal to the population of Philadelphia, and that business and building, too, are increasing each year throughout the country in an amount proportional to Philadelphia. Too, each year business is supplied with new vigor in the form of young men who are not hampered by tradition.



Henry B. Gombers

Henry B. Gombers, who has served as secretary of the Heating and Piping Contractors Association for 33 years, was the guest of honor at an Old Guard dinner, June 16. The speakers told of the high esteem in which Mr. Gombers is held by the heating industry and outlined the growth and development of the association under his guidance.

As a token of the esteem in which he is held by his friends, Mr. Gombers was presented with a check by Stewart A. Jellett. In his response Mr. Gombers thanked the many friends who had given him loyal support throughout the years he was secretary.

Morning Session, June 17

In the report of the Board of Directors the minutes of the last board meeting, June 13, were included. It was stated that the Publication Committee had decided to change the size of the Official Bulletin to 7 in. x 10 in. The June issue of the Bulletin, which made its appearance at the convention, was the first issue in the new size, and aroused much favorable comment.

Report of National Headquarters

In his report, Secretary Henry B. Gombers, stated that the increasing activities of the association made it necessary to enlarge the size of the headquarters staff and to departmentalize the work of headquarters. He spoke particularly of the creation of the Educational Department.

Assistant Secretary Joseph C. Fitts, in his report, presented details of the work of the Standing Committee on Trade Promotion under the chairmanship of Herbert A. Snow, of Boston.

"The Committee on Trade Promotion," he stated, "was greatly hampered by the lack of facts about the heating industry and its market. Two minor surveys were undertaken, one through the local secretaries and one through certain members selected by local secretaries. Both of these surveys yielded interesting information but, unfortunately, both of these surveys are incomplete. They emphasize the lack of coordinated facts in our industry, but it is the hope of both the committee and our headquarters staff that they will arouse enough interest so that this convention will authorize a thorough survey during the coming year, and that the members, realizing the importance of this work, will respond readily when asked for information.

In mentioning Certified Heating, he said that every association which has begun operation of the certified heating plant and continued to carry out the national program has succeeded. He pointed out that if Certified Heating is inaugurated it cannot be expected to cure all the ills in that city in a day.

In his report as Field Representative, Edward G. Byrd, stated that:

The grouping of several cities into one compact organization has been successfully arranged in several parts of the country; the largest grouping is the amalgamation of the Alameda County and San Francisco Associations into the Northern California Association, which also includes several smaller cities.

We are now working on a plan for suburban membership in the metropolitan associations. This plan is being tried in four or five cities and has so far been extremely successful in all of them.

Much of the secretiveness has been eliminated from our ranks by the publication of our Standards, especially the Boiler Selection Charts; we still have some loose ends that need careful consideration in the immediate future.

All branches of the industry seem to be more interested than ever before in the welfare of each other. The time is now here when the entire industry must get behind the most progressive movement in the industry—Certified Heating—aggressively and help make the plan nation-wide. It means as much, or more, to the other branches of the industry as it does to the heating contractor, to have only correct installations made, to have them made by a responsible and reputable contractor, to have a system that will operate economically and efficiently.

Plan-making by representatives of manufacturers and wholesalers is on the decrease; those who persist in making plans for the ignorant and incompetent contractor are gradually begin-

ning to see what such a policy leads to and are abandoning it in certain sections of the country. However, the policy is not being abandoned as promptly and quickly as good business should dictate. The complete abandonment of such a policy will mean the release of thousands of dollars for constructive promotional work and the time of many salesmen who now think they can only sell goods by way of the drafting board. Trade Practice Rules may eventually outlaw this uneconomical practice, but in the meantime we must help to effect our own cure.

There is quite an unrest among the contractors, in certain sections, regarding the Trade Practice Rules of the manufacturer and wholesaler. Part of it is caused by their lack of knowledge of the true conditions regarding the development and application of the rules, and then there is a feeling on the part of the contractor, who is a large purchaser of material, that he is not recognized in a quantity discount which should accumulate on a year's purchases, similar to those allowed the wholesaler under the present published price lists. It is a fact, when such a discount was in practice before, that it was badly abused, to the detriment of those who now desire it; on the other hand, if the policing under the Trade Practice Rules is as good as we are told it is, it might work now. How much this agitation will amount to, I am unable to determine, but it has become marked in the last few months.

Last fall was spent on the West Coast, during which time the seven far Western States set up the Western Coast Conference, which will materially help the membership situation in those states. It is the first grouping of states that has been made and should prove extremely interesting and beneficial to the membership in those states.

S. Lewis Land, recently appointed director of the Educational Department, in his report gave the program of this department, which includes administrative and general promotional service, and business management service.

A report of the Membership Committee, of which Ray L. Spitzley is chairman, showed that the largest membership increase has come from New York State, which showed a gain of 40% during the year. Mr. Spitzley paid tribute to William J. Olvany, president of the New York State Association, and William G. Fraser, chairman of Zone 2. Illinois was second during the year in membership increase. The idea of the Membership Committee is to strengthen and reinforce existing organizations rather than to begin scattered groups isolated from those already organized. This will include the promotion of membership in suburban districts adjacent to cities and to group cities, wherever possible, in order to secure greater cooperation and to make the value of membership more worth while.

George M. Getschow, chairman of the Sub-Committee on Boiler Output, was ill at the time of the convention and the report of this committee was read by Harry M. Hart, a member of the committee. Mr. Hart said that they had received many inquiries concerning the rating of boilers designed for coal, but which were to be installed as gas or oil-burning boilers. The Boiler Output Committee recommends that the same ratings be used regardless of the type of fuel, inasmuch as the owner may eventually decide to return to coal. The committee stated that:

We are frequently asked what effect the American Society of Heating and Ventilating Engineers Boiler Rating Code will have on our present standards. We are frank enough to say we do not know.

The American Society of Heating and Ventilating Engineers has merely adopted a code for testing heating boilers and two suggested forms that the boiler manufacturers are asked to use in giving out the results of the tests. These forms are very similar to the tests and Performance Charts adopted by the Heating and Piping Contractors National Association in 1925, and later adopted by the Institute of Boiler and Radiator Manufacturers.

At least one boiler manufacturer is now publishing his data in this form and also is giving recommendations for selection which conforms very closely with our own recommendations.

We believe that the American Society of Heating and Ventilating Engineers in deciding that performance data on each boiler were desirable have arrived at the only logical conclusion. Such information is not only very helpful to the heating engineer, but to the manufacturer himself. Whether or not the boiler manufacturer will carry out these recommendations remains to be seen. We hope he will as it is our original idea.

Opening Session of the 41st Annual Convention of the Heating and Piping Contractors National Association, The New Yorker Hotel, New York, June 16, 1930

However, it is going to be a long and expensive operation for the manufacturers, so in the meantime it is our intention to carry on as at present, which seems to be meeting with a great deal of satisfaction to our members as well as boiler manufacturers.

The Steel Heating Boiler Institute has adopted a definite code for rating steel heating boilers based on physical dimensions. Such a code may be justified by the similarity in design and general characteristics of all steel heating boilers. Their standard ratings are based on design load; that is, radiation, piping and any other connected load. They claim that steel heating boilers rated on this code have enough overload or reserve capacity to take care of the maximum starting load. After a careful check your committee has decided to accept these ratings with some slight modification.

Of course, our net loads are based on net installed radiation equivalent and include a small factor of safety.

The same factors are applied to all steel heating boilers that are rated on the Steel Heating Boiler Institute Code. This has greatly simplified our work on the steel boilers and we are very appreciative of the fine work the manufacturers have done in all agreeing to rate their boilers on the same basis.

Our published recommended net load ratings are always submitted to the home office of each boiler manufacturer before they are sent to our members. Notwithstanding this fact we have had considerable correspondence with some of our local associations, due to the activity of local boiler manufacturers' representatives' criticism of the net loads recommended for their particular boilers.

Ralph S. Franklin, chairman of the Standards Committee, showed a copy of the new "Engineering Standards," which has been enlarged both in pages, size and in volume. The new book includes additional data on heat transmission factors, and a somewhat different table has been adopted for the radiation estimating sheets. In the old table different sheets were used for each city, taking into account the exposure in that city and the temperature difference. The new tables will have the temperature difference and exposure factor combined into one factor so that the table will be basically the same for all cities.

John H. Zink, chairman of the Sub-Committee on Welding, said that the committee had decided not to collect all the known data on welding, because such practices are largely individual, and instead the committee will work up original specifications and standards for this welding manual, which will be published about November. It will be sold for 25c to members, and $1 to non-members. Mr. Zink said that Mr. Land of the Educational Department had given him the utmost cooperation and that the Bureau of Standards had also been of tremendous assistance. In his opinion, the association's Standards on Welding, adopted by the Heating and Piping Contractors National Association, will substantially be those adopted by the Bureau of Standards.

Joseph C. Fitts

Newly-appointed Secretary of the Heating and Piping Contractors National Association.

N. Loring Danforth described the operation of the Quantity Survey Bureau in Buffalo. This bureau is a separate organization from the Heating and Piping Contractors Buffalo Association and is organized as a separate corporation. Members of the association are stockholders, and in addition two outside contractors hold stock. A heating engineer is employed to take off quantities, copies being furnished to members. The expenses of the bureau are obtained by a $5 fee which is charged each member for his copy of the quantity sheet, and in addition the successful bidder pays from 2% (on jobs up to $1000) to a flat charge of $400 (for $75,000 to $100,000 jobs).

All members who receive a copy of the Quantity Survey pay the fee, whether they use the Quantity Survey or not. If plans are not completely drawn for the heating and piping, layouts are furnished at double the rates outlined above. The surveys are confidential, no prices are included and the list of competitors is not given out. Although there are no prices included, there is a labor schedule showing the items which must be carried out.

Morning Session, June 18

In the report of the Committee on Trade Promotion was presented the report of the joint committee of the Heating and Piping Contractors National Association and National Association of Master Plumbers on Trade Practice Rules for the plumbing and heating contracting industries.

An outline of four principles of credit policy was proposed by the Trade Promotion Committee, and a survey of the heating industry by Joseph C. Fitts. In its report the committee said:

Your Committee on Trade Promotion has studied during the first year of its existence how our business might be placed on a more satisfactory and more profitable basis.

We decided early in our deliberations that we must know more of the causes of our indisposition and only propose remedies when we felt sure that they would build up the strength and vitality of the whole industry.

There are two movements under way at the present time which seem to your committee to be worthy of the most careful consideration as parts of a nation wide effort to secure better business conditions.

The first movement is that which seeks to provide more sound conditions of Credit Control and Extension.

The second movement is that which seeks to provide, under the Federal Trade Commission, for the establishment of fair trade practice rules.

Your committee prepared and published in the March issue of our *Official Bulletin* a statement of what we believe is an accurate standard of credit policy, which if recognized and adhered to by all branches of our industry would result in vastly improved conditions in the financial structure upon which we operate.

These principles are as follows:

1. The ability of the applicant for credit to furnish regular financial and operating statements.

2. The ability of the applicant for credit to operate his business successfully on a volume which is within the limits indicated by proper consideration of capital and operating expense.

3. The possession by the applicant for credit of technical knowledge, craftsmanship and business ability to successfully execute the various projects undertaken by the concern.

4. Habits of payment of the applicant for credit as shown by interchange of information between various sources of supply.

The committee recommends that, after proper consideration by this convention, the four Principles of Credit Policy be approved and made effective in every part of the country.

The second movement having to do with the Federal Trade Rules is one of far-reaching significance.

At the present time over one hundred industries have had Trade Practice Conferences and have created organizations for the distinct purpose of making their rules effective.

A perfect observance of these Trade Rules is, of course, impossible to obtain, but it is the experience of many of these industries that where there has been an honest effort to observe the rules, a very marked improvement has been evident in the conduct of that industry.

The manufacturers and wholesalers of plumbing and heating material have prepared and have established Trade Practice Rules under the Federal Trade Commission; have organized as the National Plumbing and Heating Institute; and have this past year operated under the guidance of F. W. Swanson, as Commissioner, and Max F. Burger, as assistant.

Committee Recommends Support of N. P. & H. I. Rules

We believe and recommend that this convention should go on record in approval and in support of the Trade Practice Rules of the National Plumbing and Heating Institute.

At the National Convention of the National Association of Master Plumbers held last year at Buffalo, and at our own convention in St. Louis, resolutions were adopted approving of the appointment of a joint committee to consider the possibility of Federal Trade Practice Rules for the heating and plumbing contracting industries.

The president of the National Association of Master Plumbers appointed a committee consisting of H. E. Longley, L. McNamara, and Harry Sugarman. The board of our association appointed the Committee on Trade Promotion to act with the Committee of the National Association of Master Plumbers on this matter.

Two joint meetings have been held and a tentative set of rules prepared and have been submitted to the separate national boards of directors.

It is our desire that these rules be considered carefully by this convention.

If they should meet with general approval and should be found to represent the wishes of a large majority of the heating and plumbing contractors, it would then be necessary to arrange for a hearing before the Federal Trade Commission in Washington.

This hearing should be attended by a large representation of our membership and of those not directly affiliated with our organization, and also by an equally representative group of master plumbers.

Should these Trade Rules be approved by the commission, it then becomes the duty of both national associations to provide means for their enforcement.

In his paper entitled "The Heating Industry—A National Survey," Joseph C. Fitts, assistant secretary of the association, presented some valuable data for which three studies were made:

First: A survey of general conditions in each city in which there is a local association;

Second: A study of what the available market might be;

Third: A study of last year's business as shown by the reports from one hundred heating and piping contractors scattered throughout the country.

In regard to the size of the market, Mr. Fitts reached the conclusion that the new building market for heating is $500,000,000 per year.

In referring to the heating and piping contractor survey of 100 contractors representing a cross section of the membership of the association, it showed that 15 had sales under $40,000, 15 had sales from $40,000 to $80,000, 20 had sales from $80,000 to $150,000, 31 had sales from $150,000 to $300,000, and 19 had sales over $300,000.

The survey also showed that 38 own their place of business, 60 rent their place of business, and the average rent paid is $1,928; 73 carry a stock of merchandise, 10 carry a small stock of merchandise, and 16 carry no merchandise.

Other figures show total sales, $23,169,819; average sales, $231,698; total operating expense, $3,161,734; average operating expense, $32,262; total executive salaries $1,209,218, and the average per company equals $13,002. Eighty-six discount their bills.

Under profit and loss, 75 report total profit of $902,609, average $12,034; 12 report total loss of $106,232, average $8,876; 12 report no profit or loss; net profit is shown as $796,377, and average profit, $8,044.

From data secured from 83 complete reports, are shown sales amounting to $19,185,359; operating expense $2,873,592; profit $813,718, and loss $106,232. Net profit is $707,486, and profit equals 3.68% of sales.

From these eighty-three reports are also shown cost of material and labor $15,604,281; operating expense $2,873,592, and true cost $18,477,873; with a profit of $707,486; the sales amount to $19,185,359. Operating expense equals 18.41% of cost of material and labor.

The discussion on Mr. Fitts' survey showed that there is considerable interest in this subject, and several suggestions were made that this survey be broken down into groups according to the amount of business they do, and that the survey be continued to obtain further information. It was suggested that in view of the small profit shown on this report, a larger percentage of the profit came as a result of discounting bills than from any other source.

In his talk on "Cooperation of Heating Contractors with Jobbers and Manufacturers," Walter H. Oleson, manager of the Heating and Piping Contractors Boston Association, spoke of methods in that city whereby the contractors obtain cooperation with other interests to the benefit of the contractor. Among such cooperative measures was an agreement with the local gas company.

In the discussion of the trade rules it was pointed out that the first group are those which are unfair and can legally be held to be a violation of trade practice rules, if such rules are accepted by the Federal Trade Commission, while Group 2 can be classified as rules which the industry condemns, but which cannot necessarily be enforced. It was asked whether combination bids of plumbing and heating were illegal under these rules, in reply to which Mr. Gombers pointed out that combination bidding was condemned by the National Association of Master Plumbers and the Heating and Piping Contractors National Association many years ago.

The question was brought up as to whether these rules would apply to contractors who were doing intrastate, rather than interstate business. Mr. Burger replied that practically all contracting business is interstate, inasmuch as the classification depends on the shipment of merchandise used rather than on the agreement between the contractor and owner and architect. Practically every job contains some material shipped in from another state, so that contracting thus becomes an interstate business.

George B. Richmond, secretary of the Heating and Piping Contractors Memphis Association, spoke on "Selling Certified Heating to the Architect and Engineer."

"Trade Promotion in the Heating Industry" was the subject discussed by Homer J. Buckley, the keynote of his address being that heating contractors should do more advertising and less personal salesmanship and make their personal salesmanship of a higher quality.

Welding Luncheon

John H. Zink, chairman of the Sub-Committee on Welding, who presided at the luncheon, said that half-inch pipe can be welded just as well and as economically as 12-in. pipe, but exploded a common fallacy that the small pipe can be butt-welded. The new specifications of the welding committee state that all pipe, regardless of its size, must be bevelled.

The question was asked whether a

contractor beginning welding should purchase oxy-acetylene or electric-acetylene welding equipment. This was answered by Mr. Zink who said that the contractor should begin with oxy-acetylene equipment, especially since the first cost was so much less.

Mr. Zink reported on some tests in which he had participated which showed that the average strength of butt-welded pipe was but 28% of that of the pipe itself, whereas the welded joints which had been bevelled were stronger than the pipe. In regard to burning of the pipe, Mr. Zink stated that it is sometimes said that the high temperature of the welding torch will burn the pipe. The temperature of the torch is 4800° F., but this is reduced from 1500° to 1800° in the open air, so that the temperature of the flame is only 300° above the melting point of the pipe, 2700° F. The extra 300° is necessary to flux the welding iron.

Mr. Zink emphasized the point that welding should not be spoken of as cheap, but that it should be pointed out that it is better and, in most cases, more economical.

Association for Correlating Thermal Research

Plans for the future activities of the Association for Correlating Thermal Research were discussed at one of the noon-day luncheons during the convention. Joseph C. Fitts, chairman of the board of directors of this association, introduced the subject by stating that the work had now proceeded to a point where some further action was necessary to insure its continuation. It was brought out in the discussion that the association now has, in card index form, probably the best bibliography of technical articles on subjects connected with thermal research ever compiled.

On the question of whether it were better to proceed as a semi-independent organization or to amalgamate it with the A.S.H.V.E., the sentiment proved quite general that logically the A.S.H.V.E. was the proper body to continue the work. It was felt to be the sentiment of the meeting that the A.S.H.V.E. be approached on the matter with the idea of having the other associations interested contribute to the maintenance of the work.

Afternoon Session, June 18

Under the direction of Dr. F. R. Cawl, of the Philadelphia Public Ledger, a sales demonstration was staged at the afternoon session, June 18, which held the interest of all present until a late hour. During the noon recess the convention platform had been transformed into a living room. As the scene opened, E. D. Greenfield as the home-owner, and Miss Moses, as his wife were spending a quiet evening when a salesman for certified heating was announced in the person of Ray A. Kosel.

The second demonstration was in the same home with a different salesman. This time E. W. Mandevi'le took the part.

In the third demonstration an architect and an owner were interviewed by a certified heating salesman in an effort to have the architect recommend this method for a duplex apartment house. The characters in this scene were: Irving J. Bush, representing the architect; J. R. Hartman, the owner, and S. L. Haas, the salesman.

As each demonstration proceeded, the actors were interrupted by shouts of laughter as the conversation betrayed the lack of knowledge of the householder on heating subjects and the difficulties of the salesmen.

During the interview Doctor Cawl was busy taking notes. At the close of the demonstrations he analyzed them in detail for the benefit of the assemblage. His principal conclusions were that much work remains to be done in "putting over" the story of certified heating, particularly with regard to making the home-owner realize its benefits and the architect its advantages as compared with the usual practice.

Convention committees were appointed as follows:

Auditing: L. G. Kirk, chairman, William W. Hubbard, and Harry Geiser.

Credential: Joseph G. Hayes, Joseph McGinness, Thomas O'Callahan, and A. Bachman, secretary.

Nominating: Joseph F. Himmelspach, secretary; Howard E. Crook, chairman; Thomas I. Magan, E. A. Anderson, W. E. Coley and C. P. Finke.

Resolutions: B. Y. Kinzey, secretary, John P. Baldwin, chairman, George P. Nachman, Merwin K. Porter, John E. Rutzler, Jules E. Strong.

Reception: New York City Association.

Morning Session, June 19

Reports of the various convention committees were presented at this session. In the report of the Nominating Committee, Joseph E. McGinness, R. Carter Beverley, Harry M. Hart and John H. Zink were proposed for directors, three-year term. For the two-year unexpired term of Frank W. Howard, Herbert A. Snow was nominated. Officers proposed were: President, Walter Klie; vice-president, Ray L. Spitzley, and treasurer, Robert D. Williams. All of these were elected, this making the third term for President Klie.

The resignation of Frank W. Howard from the board of directors and vice-presidency was accepted and Mr. Howard was elected to honorary membership.

"Publicity in the Heating Industry" was the subject of an address by Norman J. Radder, who told of the work the Plumbing and Heating Industries Bureau is doing in obtaining publicity in various trade magazines and newspapers in selling the idea of radiator heat, certified heat, etc. Russell G. Creviston, Sales Promotion Manager of Crane Company, spoke on the "Commercial Value of Research." The majority of Mr. Creviston's remarks were confined largely to the activities and importance of the Association for Correlating Thermal Research, of which Mr. Creviston is a member.

A resolution was offered to the effect that the practice of vacuum specialty companies in helping contractors make up estimates in lump sum bids be condemned, and urged that these manufacturers issue list prices and discount sheets from time to time as is done by boiler and radiator manufacturers. In the discussion of this resolution, Mr. Hart pointed out that this organization was an aid to the small and irresponsible contractor who is unable to work up his own estimates, but imposed on the manufacturers themselves. The resolution was adopted.

It was approved that an investigation be made of the confusion of the terms "certified heat," "gold bond heat," "guaranteed heating" and other such terms, and that the Trade Promotion Committee cooperate with manufacturers to eliminate as far as possible such confusion.

Trade Practice Rules adopted by the Plumbing and Heating Institute were commended, and a resolution was passed that they be supported by the association.

Specifications presented by the Sub-Committee on Welding were approved.

Trade Practice Rules submitted by the joint committee of the association and the National Association of Master Plumbers were approved and a resolution passed to the effect that a committee be appointed to work with the National Association of Master Plumbers to petition the Federal Trade Commission to hold a hearing on these rules.

Discussion on the question as to the possible moving of the national headquarters from New York to Washington became rather involved, and the question was finally left up to the board of directors to investigate the matter thoroughly and obtain an expression of opinion from the members as to the advisability of moving the headquarters.

Resolutions of regret and condolence were passed on the deaths of Edmund Grassler, George H. Morrison, David Desmond, Horace Jones and J. B. Walker.

Plant Extensions and New Fields of Service Feature Year's Work of District Heating Utilities

IMPORTANT district heating extensions, notably the change-over from hot water to steam in Indianapolis and the new underground construction in Boston, were among the significant developments reported at the twenty-first annual convention of the National District Heating Association, in St. Louis, June 3-6.

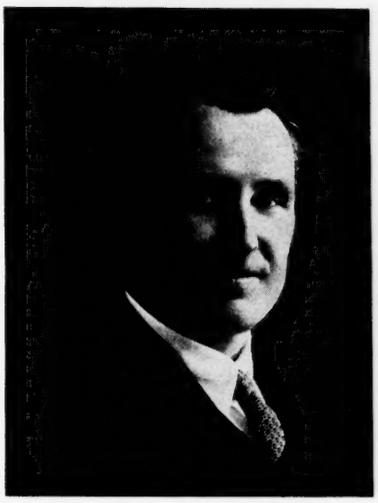
Many of the companies also are becoming interested in the air-conditioning field as a means of building up their power load. As one of the delegates expressed it: "From our point of view, air conditioning is interesting to us entirely from the power standpoint so that we have the anomaly of the electric power department, rather than the heating department, going after this business." At the same time it is worth while to note that the Union Electric Light and Power Company of St. Louis exhibited with considerable pride an air-conditioning system in the company's sales offices which serves to cool the main showroom on the ground floor and many of the executive offices on the ninth floor.

In seeking new sources of business some of the companies have devised an ingenious arrangement for utilizing unit steam heaters in the casings of warm-air furnaces, thereby substituting steam for the direct firing of the furnace.

There was plenty of evidence that district heating is making notable progress and that, speaking generally, the companies are in a favorable position.

New officers of the association proposed by the Nominating Committee, of which J. H. Walker was chairman, are:

President, Landon Shaw Smith, Rochester Gas and Electric Corp., Rochester, N. Y.; first vice-president, W. W. Stevenson, Allegheny Steam Heating Co., Pittsburgh, Pa.; second vice-president, E. E. Dubry, Detroit Edison Co., Detroit, Mich.; third vice-president, J. E. Seiter, Consolidated Gas, Electric Light and Power Co., Baltimore, Md.; secretary-treasurer, D. L. Gaskill, Greenville, O.



Landis Shaw Smith

President of the National District Heating Association

Mr. Smith was educated at the Mechanics Institute, of Rochester, N. Y., and at the University of Michigan, where he studied electrical engineering.

During the World War he was connected for six months with the Ambulance Service and for a year and a half was pilot instructor and aerial gunnery instructor in the U. S. Army at Mount Clemens, Mich.

After the war he became connected with the Rochester Gas and Electric Corporation as sales engineer on industrial gas and refrigeration work. Since 1922, Mr. Smith has been sales engineer for the company on district steam sales and service and heating and ventilating problems. At present he is in charge of the company's division of steam sales.

Executive committee, above-named officers and J. E. Hillemeyer, Union Electric Light and Power Co., St. Louis, Mo.; and William J. Baldwin, New York Steam Corp., New York.

Morning Session, June 3

A full attendance greeted President J. C. Butler when he called the convention to order at the Coronado Hotel in St. Louis, June 3. After a welcome to St. Louis extended by the secretary of Mayor Victor J. Miller, and the response of Secretary D. L. Gaskill, President Butler presented his annual report.

In his report President Butler said in part: "It has been a year of advancement—not necessarily spectacular, for the nature of our business is such that its progress is slow but substantial. It may not have equaled the phenomenal growth of the past few years but with few exceptions we can look upon it with pride.

"The general curtailment in building since the first of the year has, to a great extent, reduced the demand for increased plant capacity and service extensions. Many companies have ample capacity as a result of recent additions and improvements. For this reason there will be little need for many large developments this summer.

"With the let-up in new building, it is necessary to solicit prospective business which has been difficult to obtain in the past—business which was neglected to care for that which came to us without much effort or solicitation."

Mr. Butler referred to the decision of the Executive Committee to issue membership certificates and to the testimonial dinner tendered last Fall by the Executive Committee to Alex Dow, president of the Detroit Edison Company, on the occasion of his election to honorary membership in the association.

Mr. Butler also commented on the paper prepared on "The Present Status of District Heating in the United States," by J. H. Walker and A. R. Mumford, with the assistance of the Educational Committee of the National District Heating Association, presented at the World Power Conference held in Berlin, June 16 to June 25.

In referring to the association's *Bulletin*, Mr. Butler stated that it was planned to issue the *Bulletin* bi-monthly, instead of quarterly.

On the subject of the National District Heating Association Handbook, Mr. Butler stated that the Educational Committee, assisted by Professor Hotchkiss, and under the leadership of Chairman J. H. Walker, has outlined a complete and comprehensive program for the compiling and publishing of a new handbook. It is expected that the new edition will be issued some time during the coming year.

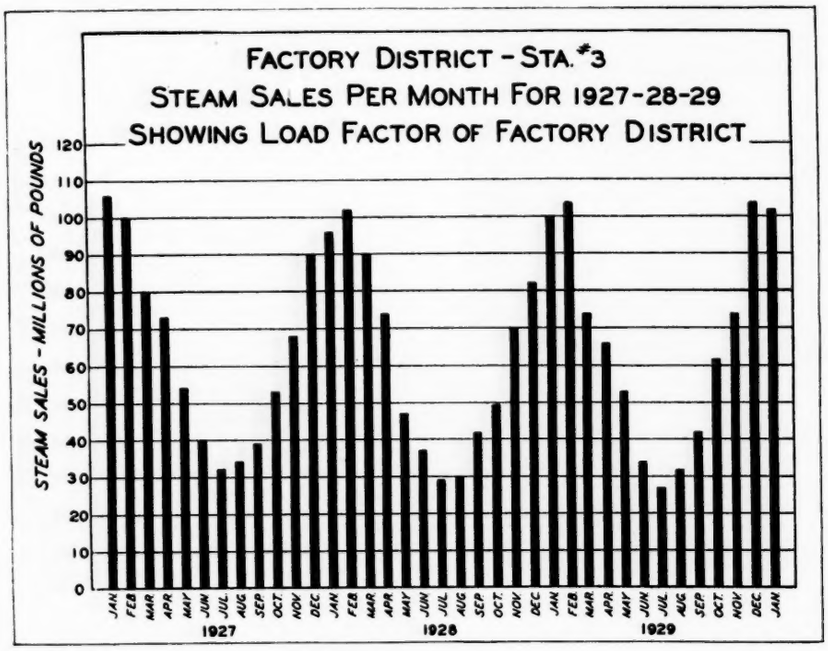
Secretary Gaskill reported an increase in the association's membership from 327 to 338 members.

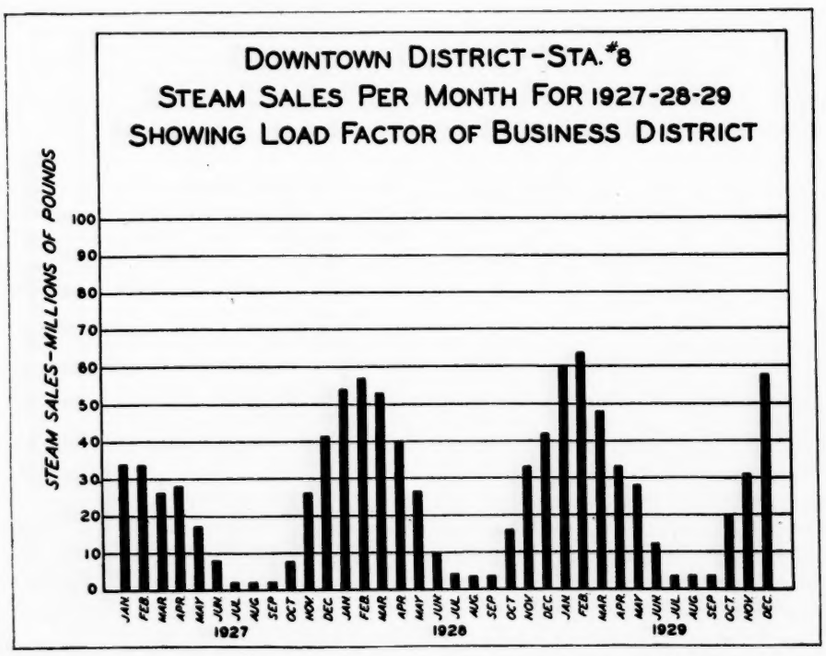
On the subject of the *Bulletin* of the association, Mr. Gaskill stated:

"There was some talk during the past year of working out an arrangement with some one of the trade journals so that the *Bulletin* might be discontinued and the work done through the columns of such a journal. I am not averse to such a plan and if such an arrangement could be worked out to advantage so that it would still reach the membership of our organization, I believe it should be considered. However, it is to be remembered that any trade publication will go only to those who are actual subscribers thereto, and it is a well recognized fundamental plan that no association can afford to operate without having some means of tying-in with the membership and bringing to them at periodical times something that will show the work of the association as it is progressing."

He reported total receipts for the year of $12,154, and total expenditures of $13,197. The balance on hand at the end of the year was $2928.

Chairman J. H. Walker, of the Educational Committee, outlined plans and methods that are being followed in the preparation of the new edition of the association's Handbook. He was followed by Prof. C. H. B. Hotchkiss, of Purdue University, who has charge of the compilation of the material for the new edition.





Comparative Steam Sales and Load Factors in Factory and Commercial Districts of Rochester, New York

N. D. H. A. Handbook

Professor Hotchkiss stated that whereas the present edition of the N.D.H.A. Handbook makes no claim to be a complete treatise or textbook on the subject, the new edition will veer more towards the textbook idea and its scope expanded to include material on such non-technical subjects as rates, management, etc. Aside from these changes, the new edition will correspond to the first edition.

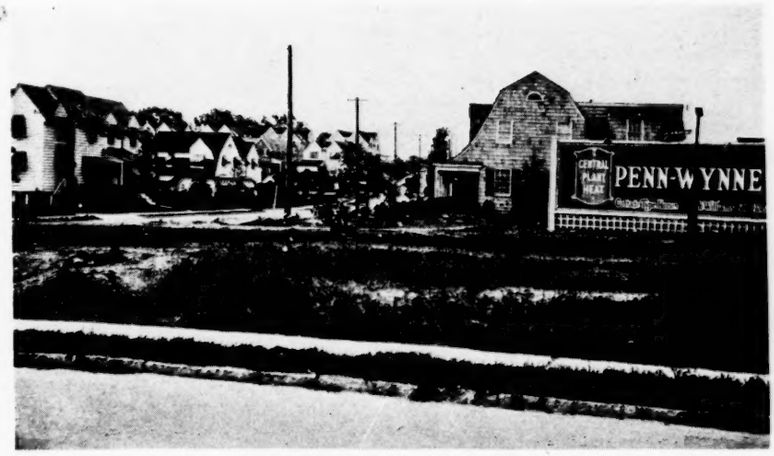
Three general headings will carry the material: 1, general information and data; 2, steam heating, and 3, hot water heating. It is planned to devote over half of the book to the data on steam heating. Preparation of the chapters will be delegated to sub-committees. Chapter outlines are tentatively as follows:

Chapter		Pages
	Introduction	10
I.	General Data	20
II.	Customers Heating Systems.	20
III.	Customers Miscellaneous Apparatus	20
IV.	Steam Distribution	70
V.	District Steam Plant	30
VI.	Steam Meters and Metering.	30
VII.	Hot Water Heating	20
VIII.	Rates and Rate Making	40
IX.	Sales Activities	20
X.	Economical Use of Steam	20
	Total	300

Afternoon Session, June 3

With Vice-President L. S. Smith in the chair, Chairman E. E. Dubry of the Research Committee presented his report. It included a comparison between industrial and business steam heating districts, together with a study of residential and apartment house-heating when this class of buildings is not adjacent to the existing district heating system. Another subject incorporated in the report was a discussion of the steam accumulator and its possib'e uses in a district heating system.

Under the first topic Mr. Smith described the development of district heating in Rochester, N. Y., where his company is located. At first the service was limited entirely to the factory district and gradually grew until now the company has 134 customers using 820,000,000 lbs. of steam annually. In the business district, the service which was inaugurated in 1925, is now serving 154 customers with a consumption of 365,800,000 lbs. annually, so that the amount of steam sold in the factory district having fewer customers is over twice that sold in the downtown district. At the



How Central Plant Heat Is Advertised in Connection with a Residential Building Project

Note distribution piping laid on ground to reduce construction costs

same time the distribution system of the factory district is 42,000 sq. ft. of pipe surface, while the downtown district is 77,000 sq. ft. or nearly twice as much. Consequently, the amount of steam sold per square foot of pipe surface is four times as much in the factory district as in the downtown district.

As Mr. Smith pointed out, the steam mains in the factory district were built at a decidedly lower cost than those in the downtown district. Moreover, much of the factory distribution system was installed some years ago when materials and labor were cheaper. These and other factors account for the fact that the downtown district heating system costs nearly four times as much as that for the factory district. This means that the amount of steam sold, per dollar of distribution investment, in the factory district is approximately eight times the amount of steam sold, per dollar of distribution investment, in the downtown district.

Although the figures on the cost of the heating plants of the two districts are not comparable because of the different ages, location and construction of the plants, it is noteworthy that the heating plant of the factory district is located where property and rent are fairly cheap. In contrast to this is the expensive location of the plant in the business district. In addition, coal has to be trucked across the city to this plant.

Mr. Smith presented charts which emphasized the superiority of the industrial district to the business district. Again, rates for the downtown district are approximately 20% higher than those for the factory district, due to higher costs of construction and supplies. Mr. Smith announced that the Rochester Gas and Electric Corporation recently has purchased an isolated plant in an entirely different section of the city which is to be utilized to serve another manufacturing area.

In the committee's study of residential and apartment house-heating in isolated districts, eleven systems were investigated, of which three served apartment houses only, four served both apartments and residences, and four served only residences. All of the systems in the last two groups were started originally in connection with building projects under these conditions. The heating systems were built to pass on to the property owners in the districts served, certain charges which paid either for the entire distribution system, a portion of it, or more than its actual cost. This charge merely was added to the selling price of the property and since it was only a few dollars per foot it did not interfere with the ready sale of the property.

It was the committee's observation that where district heating service was available property sold more easily than without it, and it was quite common to see large display board advertisements featuring "Central Plant Heat." All of the heating properties inspected, with two exceptions, were making additions to the plants or to the systems or both. The larger plants were equipped with stokers and coal and ash-handling apparatus. The smaller plants were hand-fired. In one fair-sized system oil was burned. In two cases super-heated steam was used to insure dry steam on the customer's service connection.

In all the systems visited one man was in responsible charge of the entire heating project and also controlled its finances. The rates of the systems were all different, some having combined "readiness-to-serve charge" and a consumption charge, while others had a straight consumption charge, and the rest had a straight consumption charge with a coal clause. In order to compare the various heating charges all the rates were applied to the same building with the following results:

Residence at 5271 Cass Avenue, Detroit, Mich.

Installed radiation	660 sq. ft.
Theoretical radiation	732 sq. ft.
Building volume, gross	30,114 cu. ft.
Heated space	29,100 cu. ft.
Outside wall area	3348 sq. ft.
Heat loss	2510 B.T.U. per Deg. F.
Steam consumption	289,300 lbs. for season 1928-29
Cost of anthracite coal	$356 for season 1927-28
Cost of anthracite coal	$332.60 when corrected to temperature of 1928-29

Data on the use of the steam accumulator was presented in the concluding section of the report. This apparatus was described as a tank of water equipped with the necessary regulators and steam lines so that by the addition of high-pressure steam its temperature and pressure can be raised to a high level during off-peak hours. In this way the amount of heat per pound of water in storage is increased.

During the peak-load period the pressure of the accumulator is reduced and the heat added during the off-peak period is released in the form of steam at the lower pressure. This equipment has been quite popular in Europe for many years.

It was shown by the study that the cost of an accumulator depends upon the number of pounds of steam released per charge and that the equipment is especially adapted to a load with a high peak of short duration rather than a moderate peak of long duration.

Although this type of equipment, concluded the report, might not be justified in heating plants located in the business district of a modern city due to space required for its installation, the conditions are quite different where land values are low and where a high demand load is located at the end of a line.

H. J. Bauer, chairman of the Station Operating Committee, took the chair for the presentation of this report. Included in the subjects covered were: "New Plants and Additions," by M. D. Engle, Boston, Mass.; "Boilers and Furnaces," by A. S. Griswold, Detroit, Mich.; "Fuel-Burning Equipment," by J. R. McCausland, Philadelphia, Pa.; "Feed-Water Treatment," by A. R. Mumford, New York, and "Station Records and Statistics," by R. H. McCumber, Rochester, N.Y.

In selecting its subjects the committee sought information on the following questions, covered in the report:

1. What is the trend in design of strictly heating plants?

2. What performance can be expected of boiler plants in central heating plants?

3. How does the fuel-burning equipment of widely-separated plants compare and what are the factors affecting this problem?

4. What steps are being taken by the various companies in treating feed water and are they successful?

5. What records are kept for determining plant performance?

Peak load problems affecting steam heating stations formed the subject of the report on boilers and furnaces and included a tabulation of data on this subject. It was felt that if the cost of outages were similar for different companies, joint action could be taken to obtain a remedy for the condition. It was stated that there exists a common cause for outages which appears to be insurmountable.

In "Fuel Burning Equipment" was included a compilation of data pertaining to fuel and its origin and various types of equipment used for burning fuel, along with data for comparing operation in plants using the same type of equipment. The absence of cinder catchers was indicated and it was brought out that there is an ever-increasing need for equipment of this nature.

Feed-water treatment came in for its full share of attention and was characterized as a matter of extreme importance to plants operating with raw water makeup as high as 90% to 100%.

Data on Operating Statistics

For the Committee on Operating Statistics, Chairman A. D. Leach reported that figures had been supplied by 43 member companies, as compared with 38 companies last year. Among the important items in the report were the following:

Records of 33 companies indicate that 11.4% more steam was sold last year than during the previous year, with a corresponding increase in customers of more than 4% and an increase in connected load of 18.4%. By omitting the partly-estimated figures of one large company the growth in connected load was figured at 10.1%.

There were no notable changes in steam pressures although three companies advised of proposed increases.

The price of fuel declined nearly 7% and the average cost of labor increased about 3%, with a practically stable income in steam load of 85c per thousand lbs.

As Mr. Leach pointed out, a more accurate picture is obtained by reference to the summaries contained in the report. Such matters, for instance, as fuel, oil and natural gas computation, he pointed out, are having an effect on central heating in steam districts.

Other data included in the report follow:

	1929	*1928*
Customers		
(a) Number		
Companies reporting	43	38
Smallest number per company	42	34
Largest number	2,373	2,219
Total of all companies	17,155	14,257
Average per company	399	375
(b) Classification		
Companies reporting	41	36
Residential customers	1,627	1,258
Business customers	12,811	8,760
Power customers	N.R.	.....
Industrial customers	N.R.	.....
Total	14,438	10,018
Per cent residential	11.3	12.6
(c) 35 Companies Reporting Both Years		
Total customers	13,945	13,397
Increase over previous year	548	.....
Per cent increase	4.1	.....
Cost of Fuel—Delivered in Plant		
(a) Coal—Per ton		
Companies reporting	34	29
Minimum price per ton	$2.20	$2.50
Maximum	7.60	7.60
Average	3.73	3.97
(b) Fuel Oil (per bbl. of 336 lbs. ±)		
Companies reporting	5	2
Minimum cost per bbl	$0.88	$1.16
Maximum	1.21	1.33
Average	1.07	1.31
(c) Variation in Price of Fuel		
Companies reporting both years:		
Coal—decrease over previous year, per cent	6.5	.....
Fuel oil—decrease, per cent	9.1	.....
Connected Load		
(a) Equivalent Direct Radiation (1000 sq. ft.)		
Companies reporting	32	30
Total equivalent direct radiation	54,417	42,562
Smallest company	131	130
Largest (1929 partly estimated)	16,124	11,600
Average	1,701	1,419
(b) Pounds Steam Sold per Sq. Ft. E. D. Radiation		
Companies reporting	32	30
Minimum	363	318
Maximum	684	717
Average (weighted)	500	533
Average Steam Sales (1,000 lbs.)		
(a) Per Customer		
Companies reporting	43	38
Minimum company	108	326
Maximum company	9,235	11,550
Average	1,845	.....
Average (weighted)	1,809	1,780
The same 35 companies reporting both years	2,040	2,038
(b) Steam Sold Per Pound Coal Burned		
Companies reporting	35	27
Minimum company	2.72	3.50
Maximum company	8.13	8.35
Average	6.63	6.55
Invested Capital—Proposed Capital Expenditures		
Companies reporting	27	26
Total invested capital	$91,311,000	$79,575,000
Per cent capital in production plant	56.3	.....
Gross revenue of 27 companies reporting amount of invested capital	$19,870,000	
Capital invested per dollar of annual revenue —weighted average	$4.60	.....
Capital invested (27 companies) per 1,000 lbs. steam sold	$3.69	$4.20

Proposed Capital Expenditures	*1930*	*1931*
Companies reporting	28	12
Estimated expenditures	$5,332,000	$2,816,000
Average expenditure per company	$190,000	$234,000

Evening Session, June 3

An address by President L. A. Harding, of the American Society of Heating and Ventilating Engineers, on "Applications of Heating and Ventilating Research," featured the Tuesday evening session. Owing to the unavoidable absence of Chairman John W. Meyer of the Rates and Regulations Committee,

the report of that committee was put over.

Address of L. A. Harding

Mr. Harding reviewed the work carried out at the A.S.H.V.E. Research Laboratory, particularly with regard to the development of the laboratory's "effective temperature" charts. He also gave a graphic account of recent developments in the art, mentioning particularly the rise of the unit heater which, he said, now had largely displaced fan duct systems in many classes of buildings. He commented favorably on the use of concealed heaters and discussed at some length the panel heating system installed in the British Embassy buildings in Washington. He said, among other things:

Non-ferrous extended surface-type concealed radiators are supplanting the cast-iron radiator, to some extent, in homes of the better class and in some recent office buildings. Appearance and compactness are the contributing factors in this change.

Owing to the comparatively small mass of this type of radiation, the boiler is subjected to a smaller starting-up load for the same length of time allowed for the warming-up period or, conversely, for the same starting-up load on the boiler, the time for heating up the radiator very materially is reduced.

For the same reason, when automatic temperature control is employed this part of the equipment evidently is called upon to perform its function more frequently.

Manufacturers of cast-iron radiation reported sales of 139 million square feet for 1929, so that it cannot be said that this type of direct radiator has become entirely obsolete.

Wednesday Morning, June 4

Wednesday morning's session proved of unusual interest in furnishing information and suggestions in the report of the Commercial Relations Committee regarding the installation and requirements of hot water heaters and economy coils for various types of buildings and the work of the utilization engineering department in making district heating service more popular.

Considerable information was presented in the report for use in selecting the proper size and type of economizer equipment for specific installations. Another feature of the report was the data showing the actual steam requirements for hot water heating.

Information received from six of the member companies on the annual steam requirements for building heating and for water heating was summarized in tabular form. The information covered thirty-two office and commercial buildings in five cities, fifteen hotels in six cities, and fourteen miscellaneous types of buildings in three cities.

Although the information received was considered far from adequate to arrive at a definite average standard requirement, yet, the report stated, it is sufficient to indicate that although the steam required for water heating varies over practically double the percentage range of the requirements for building heating, still it bears quite a definite relation to the building volume for certain classes of buildings. For that reason, the data, it was felt, should be used simply as an experience check on the steam requirements as estimated.

The report concluded with a discussion of various types of water heaters.

It was brought out in the discussion that the Union Electric Light and Power Company has designed a condensate recovery system in which the condensation is admitted directly to the water tank. This arrangement, described by R. McQuitty of the company, aroused so much interest that a number of the members took advantage of his invitation to inspect the installation.

One of the points brought out in the discussion was the comment by J. E. Seiter that high temperatures in the domestic service hot water were more of a disadvantage than an advantage, due to the liability of injury to the fittings.

Mr. Sanford's Address on Steam Utilization

S. S. Sanford of the Detroit Edison Company addressed the convention at this session on the methods adopted in Detroit for securing better utilization

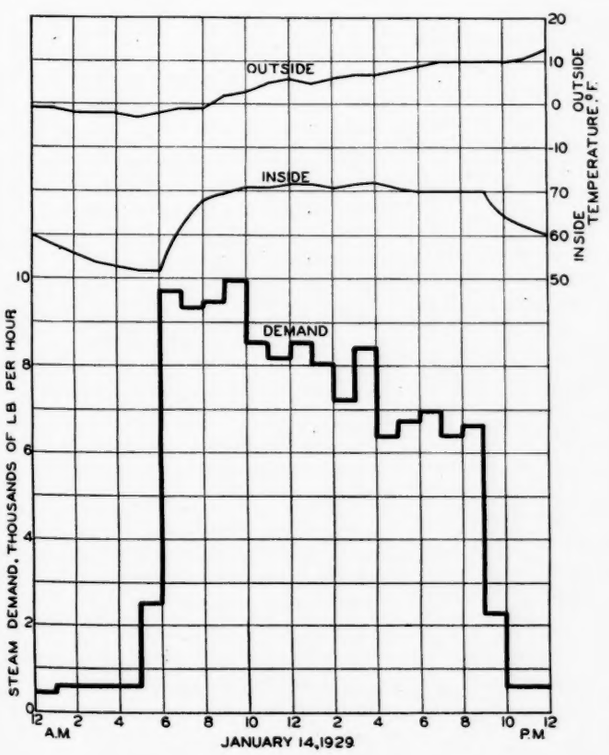


Fig. 1. Load Curve for an Office Building on a Cold Day Showing Shutting-Off at Night

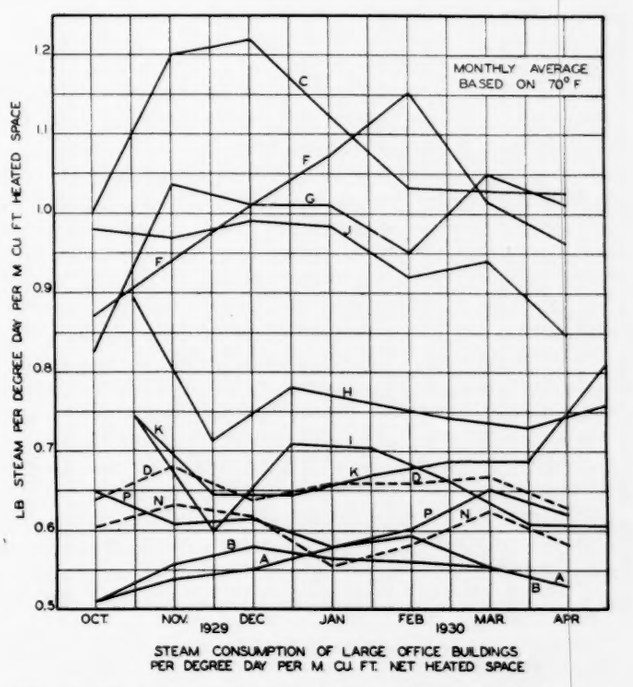


Fig. 2. Steam Consumption of Large Office Buildings per Degree-Day per 1000 Cu. Ft. Net Heated Space

a and b—High vacuum with radiator orifices. c—Vacuum return system (air conditioning in part of building). d—Orifices in radiators and mains (system controlled by roof). f and j—Intermittent control by time-clocks. g—Vacuum return system. h—Orifices in radiators. i, p and n—Moderate vacuum carried in radiators. k—Self-contained thermo radiator valves.

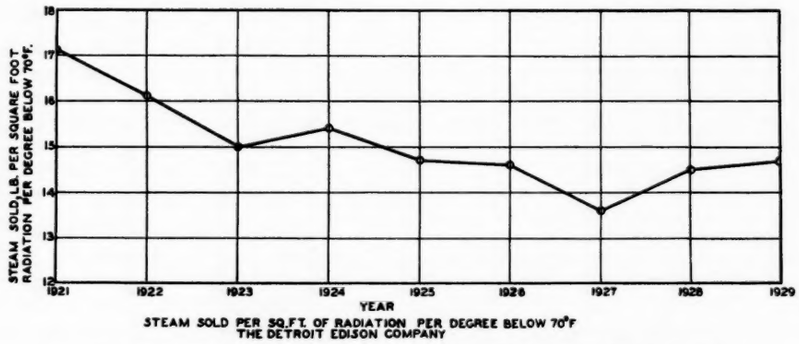


Fig. 3. Steam Sold per Square Foot of Radiation per Degree below 70° F., The Detroit Edison Company

of district steam service. One of Mr. Sanford's principal points was the economies accruing from shutting off the steam at night. The economy of this practice, he stated, has been proven beyond all doubt.

In Detroit, where the company has over 2000 customers, and over seven million sq. ft. of radiation, the company employs four engineers and two clerks whose work is equally divided between field and office. The organization keeps track of the operation of 165 buildings.

In the case of new buildings, utilization work starts with the plans in the architect's office. The company's engineers discuss with the architect's engineers the general layout of the building before the piping is designed. Uses to which different parts of the building are to be put must be fully understood.

Utilization engineers must be on good terms with the architect and must be well informed on heating subjects and on the operation of heating devices and appliances.

When plans and specifications are finished and before contracts are let, the architect is requested to furnish a set of each to the utilization engineers. The utility insists that important valves out of reach be equipped with sprocket wheels and chains and that valves under floors of stores be equipped with extension stems so that they can be operated conveniently. Remote control valves are insisted upon in cases where the customer does not have access to the space where his house valve is located.

Shutting off the steam at night and the regulation of the temperature during the day is stressed. Owners are offered the use of the recording thermometers for checking conditions in their buildings. Recording-pressure gauges and demand meters also are available. During the past year the company used in this manner, 65 recording thermometers, 45 recording-pressure gauges and 50 demand meters.

Charts obtained with these instruments are studied by the utilization clerks and frequently lead to important suggestions to the owner. In case of complaints of high bills, the building is assigned to a utilization engineer for study. Where the operating force in a building is known to have changed, such building is immediately put under observation.

Steam consumption data based on installed radiation, said Mr. Sanford, usually are meaningless. The correct basis is the theoretical heat loss in B.T.U. per hour. As a practical measure, however, it is better to rely on the cubic feet of space used. There is less variation, he said, in the ratio of space to the calculated radiation than in the space to the installed radiation.

Other factors which have to be taken into consideration are the shape and exposure of buildings, tightness of windows, condition of heating system, hours of heating, occupancy of building and quality of operating staff.

Mr. Sanford also stressed the importance of the diversity factor, which he defined as the sum of the individual maximum demand of all the buildings to the simultaneous maximum demand. Hotels and apartments for instance, require heat early in the morning, whereas stores and office buildings open later. In motion picture theatres, the load comes on late in the morning.

In the absence of John W. Meyer, chairman of the Sales Promotional Committee, the report of this committee was presented by Secretary Gaskill. The committee concentrated on a number of important sales problems. One of the interesting charts contained in the report was that showing the growth of seventeen member companies from 1922 to 1929. As will be noticed, the trend is decidedly upward, those companies having practically doubled their annual sales during the seven-year period in spite of the aggressive heat saving campaign conducted during the years 1925, 1926 and 1927. Assuming the same rate of increase in the future as in the past, these utilities will sell 88 billion lbs. of steam during 1943.

The report contained a discussion of the present status of competitive forms of heat production and the comment was made that coal and oil no longer are considered as competitive, judging from the size and character of buildings being served from central station steam systems, the expressed desire of purchasers to be relieved from the responsibilities of production and, what is becoming of increasing importance, the release of capital to be used in more productive channels. Steam utilities, the report stated, operating in areas supplied with natural gas, show a decided growth indicating no trend towards purchased gas as a substitute for purchased steam. An account was given of the successful campaign conducted in Lansing, Mich., to increase the amount of business of the local district heating company.

Other items discussed in the report were: Follow-up estimates of customers' requirements, methods of recording data, and advertising suggestions, including some typical exhibits on the part of companies which materially have increased their business through systematic and aggressive sales methods aided by effective advertising.

Included in the report was a discussion by John L. McCullough on "Temperature Control Classification of Systems," which the author designated as (1) control from temperatures, and (2) temperature control.

It was stated that the committee has under way the following studies: Elements of a Survey, Study of Class of Business, Elements of Competitive Costs, Building Using Central Station Steam Service, Temperature Control Systems, Boiler Performance, Consumption and Demands of Commercial and Industrial Operation, Putting Basements to Work, Economics of Building Construction and Present Status of Central Heating Stations to Investment Houses.

The session concluded with an address by C. Leroy Austin, advocating a revision of the calendar to include 13 months of 28 days each.

In the Manufacturers' Round Table which followed, the speakers were F. I. Raymond, who described the Raymond Duostat method of heat control, and R. E. Fritsch, vice-president of Tube-

TABLE I. VARIATION IN INSTALLED RADIATION IN OFFICE BUILDINGS

Building	Radiation, Sq. Ft. Calculated For Heat Loss at 0° F.	Radiation, Sq. Ft. Installed	Heated Space, Cu. Ft.	Cu. Ft. of Space Per Sq. Ft. of Calculated Radiation	Cu. Ft. of Space Per Sq. Ft. of Installed Radiation
X	62,500	103,790	5,562,000	89.0	53.7
Y	60,000	48,760	4,411,740	73.5	90.5
Z	42,700	48,000	3,480,000	81.5	72.5

Turns, Inc., who discussed in an interesting manner the construction and adaptability of these short-radius fittings forged from seamless tubing and made without flanges so as to be readily welded. R. P. Dewey also described the Barber-Colman electric system of temperature control, manufactured by the Barber-Colman Company.

Morning Session, June 5

For the Meters and Accessories Committee, Chairman J. J. Schenk presented the report which dealt largely with information obtained from demand meter records. With the use of a graphic demand meter, information can be obtained at a reasonable cost. Practical suggestions were offered in the report with illustrations which applied to difficult flow meter installations. These were followed by a description of the long-distance pressure gauges installation on the steam distribution system in Portland, Ore., and a procedure for the control of condensation meters.

An interesting feature of the report was a number of charts showing the results of tests conducted in various buildings to determine the relations between the demand at the inlet and the demand as shown by condensation meters at the return end of steam heating systems. It was judged from the tests that the type of system used has little effect on the time of the inlet and outlet peaks, as the peak demand at the inlet varied from 1 to 9 min. and the peak demand at the outlet varied from 7 to 25 min.

As the longest time required for the peak demand at the inlet was 9 min. and the shortest time required for the peak demand at the outlet was 7 min. and the amount per minute was approximately the same at the inlet as at the outlet, it makes little difference from a demand standpoint if a demand meter is used at the inlet or at the outlet.

For the Hot Water Committee, Secretary Gaskill presented a report prepared by Chairman S. F. Delaney, of the Atlantic City Electric Company, giving the results of a questionnaire sent out by the committee with the idea of forming a schedule applicable for all plants, covering the calculation and regulation of the outgoing water temperature. One of the notable comments in connection with the report was that the number of district heating hot water plants is not large and is diminishing.

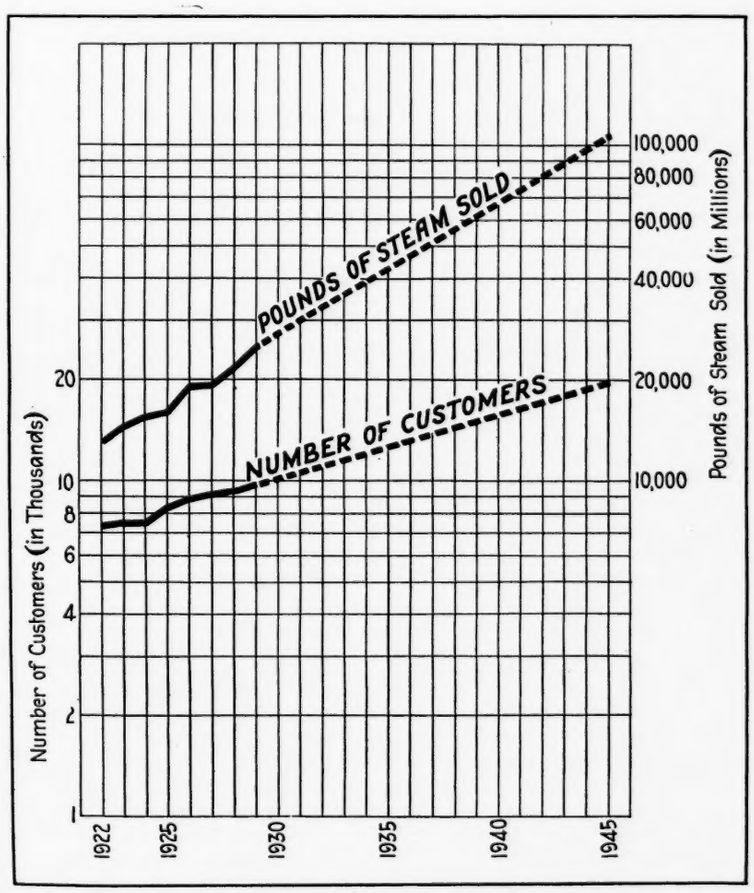
What proved to be one of the most interesting features of the meeting was a description by Paul Helm of the changeover in Indianapolis from hot water to steam. Mr. Helm showed a number of slides illustrating his talk and his familiarity with the subject added much to the interest of his presentation. He was frequently interrupted by a battery of questions and was kept busy answering them. The long applause which followed his presentation testified to the appreciation of those who were fortunate enough to be present.

In the manufacturers' round table the speakers were C. A. Thinn, chief engineer of C. A. Dunham Company, who discussed the Dunham Differential vacuum heating system, and J. V. Redfield, manager of the Central Station Steam Company, who described the new Cadillac demand contactor attachment, permitting the demand meter to be set at any convenient point and not necessarily on or even near the condensation meter. The demand meter, for instance, may be placed in the office of the building manager, furnishing a graphic continuous record not only of the steam consumed but of the manner in which steam is being used and conserved and the economy with which the heating system is being operated.

Morning Session, June 6

Under the chairmanship of Edward Lenz, of the Distribution Committee, the convention heard a masterly address by Dr. R. E. Hall, director of the Hall Laboratories, Inc., Pittsburgh, Pa., on "The Problem of Contaminating Gases in Steam." Doctor Hall discussed this highly technical subject in a way which made it easily understood by those present. His discussion covered the more common contaminating gases, such as ammonia, volatile organic matter, hydrogen, nitrogen, oxygen and carbon dioxide.

Satisfactory elimination of gases that obey Henry's law, he concluded, is readily obtained at the generating station by careful operation of standard types of degasifying equipment. As carbon dioxide in half-bound or bound condition does not follow Henry's law, special procedure is necessary to effect its limitation even to a considerably higher tolerance than is permissible for oxygen. The special procedure takes the form, in one case, of eliminating carbon dioxide by precipitation as sludge; in the other, of obviating the half-bound or bound conditions by acid treatment, thus making the dissolved gas obey Henry's Law. When plans are made for processing the water for a plant, careful consideration should be given that the procedure be chosen which is economic not alone from the standpoint of removing scale-forming impurities, but as well from that of limiting boiler-water alkalinities and



Growth of District Heating as Reported by 17 Companies, Showing Future Expected Expansion

concentration of available carbon dioxide.

By attention to these various factors, the producer is accepting the responsibility for quality of steam that should be his.

The consumer of steam in turn should accept the responsibility both of proper construction of his piping system, and guided by results of routine testing, just as in the generating station, of the proper maintenance thereof to avoid inleakage, and thereby nullification of the efforts of the producer.

In discussing Dr. Hall's report, F. N. Speller and E. L. Chappell of the National Tube Company, presented a written discussion in which they said, among other things:

"Several serious cases of corrosion of steam return lines have recently come to our attention in different parts of the country. Such corrosion is worse in some locations than in others, depending both on water and plant conditions. Some heating systems in the same district are affected more than others. Moreover, corrosion of the return lines of the same system is not at all uniform. Severe corrosion is usually characterized by grooving or pitting of the pipe, corrosion products being absent at such points as in acid attack. Corrosion products may accumulate in other sections of the pipe and in some cases, especially where excessive air leakage occurs, the pipe becomes clogged with rust.

"Until remedial measures are more generally adopted by all concerned, more trouble may be expected. Corrosion in the case of larger systems, which are becoming more numerous, is likely to be more striking on account of their size and prominence. The steam now obtained under modern boiler operating practice may be more free from caustic alkalies than was sometimes the case before. Silica of soda (containing caustic) has been found beneficial in correcting acidity when injected near the top of a steam heating system.

"Some experiments we have made recently in the field and laboratory indicate an advantage in the use of copper steel in steam returns where carbon dioxde is likely to be excessive. Generally speaking, no material difference has been found between the rate of corrosion of wrought-iron and steel without copper in neutral water, nor would any decided difference be expected due to metal composition, comparable with the predominating influence of oxygen and other factors.

"For some time, the principal factors involved in this problem have been recognized, viz., free oxygen; carbon dioxide; volume and temperature of condensate; velocity of flow of condensate; drainage, etc. The amount of oxygen is usually the most important of these factors in promoting this type of corrosion. It has been pointed out before that the oxygen may originate in the feed water to the boilers, or may come from leaks in the system, or from both sources. Low-pressure systems must, from the nature of their operation, at times admit air. Tests for oxygen in several buildings receiving steam from central heating plants have indicated that in some cases most of this gas comes from the feed water and that in other cases leakage in the heating system is undoubtedly a large, if not the predominating, factor.

"So far as the steam generating plants are concerned, means for efficient deaerating are now available and Dr. Hall has indicated treatment by which the carbon dioxide contents of steam may be kept at a minimum. The prevention of air leakage in heating systems should at the same time receive more attention.

"Much remains to be learned as to the facts and the relative importance of the factors involved in this problem, including:

(1) The proportion of corrosion due to impure steam from boilers and due to air leakage.

(2) The distribution of corrosion in heating plants.

(3) The effect of trapping condensate.

(4) The conditions of equilibrium of ferrous bicarbonate with oxygen at various temperatures.

(5) The influence of carbon dioxide and oxygen together in various proportions on the corrosion rate indicating practical maximum limits of oxygen and carbon dioxide concentration in steam used for heating.

(6) The solubility of carbon dioxide in pure water at various temperatures with the acidity of such solutions.

(7) Means for more complete elimination of oxygen and carbon dioxide from all sources.

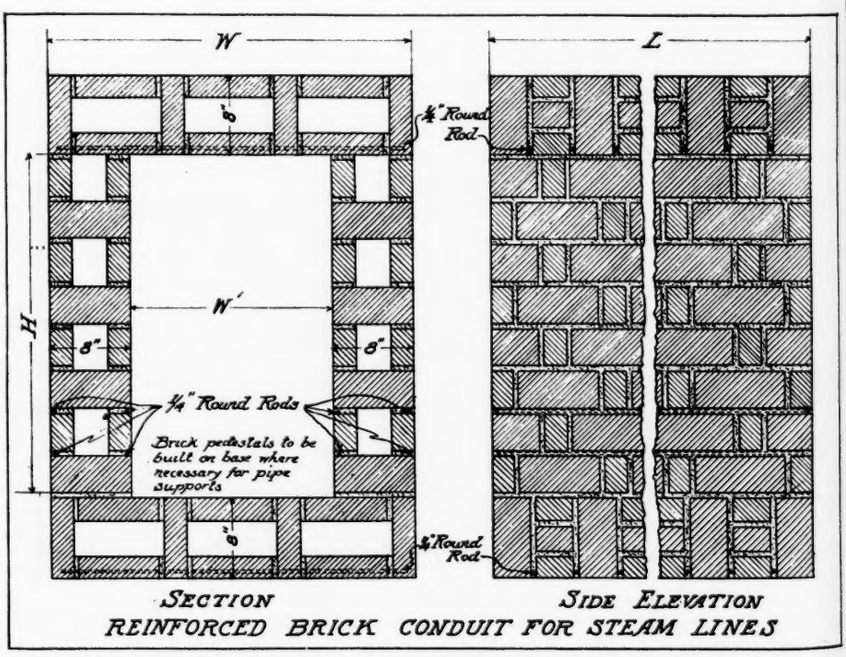
(8) Stricter construction specifications including threads and threading dopes for making tight joints."

Acting upon a suggestion of Mr. Speller, a motion was made by J. H. Walker that the association appoint a committee to give further study to this subject. The motion was carried.

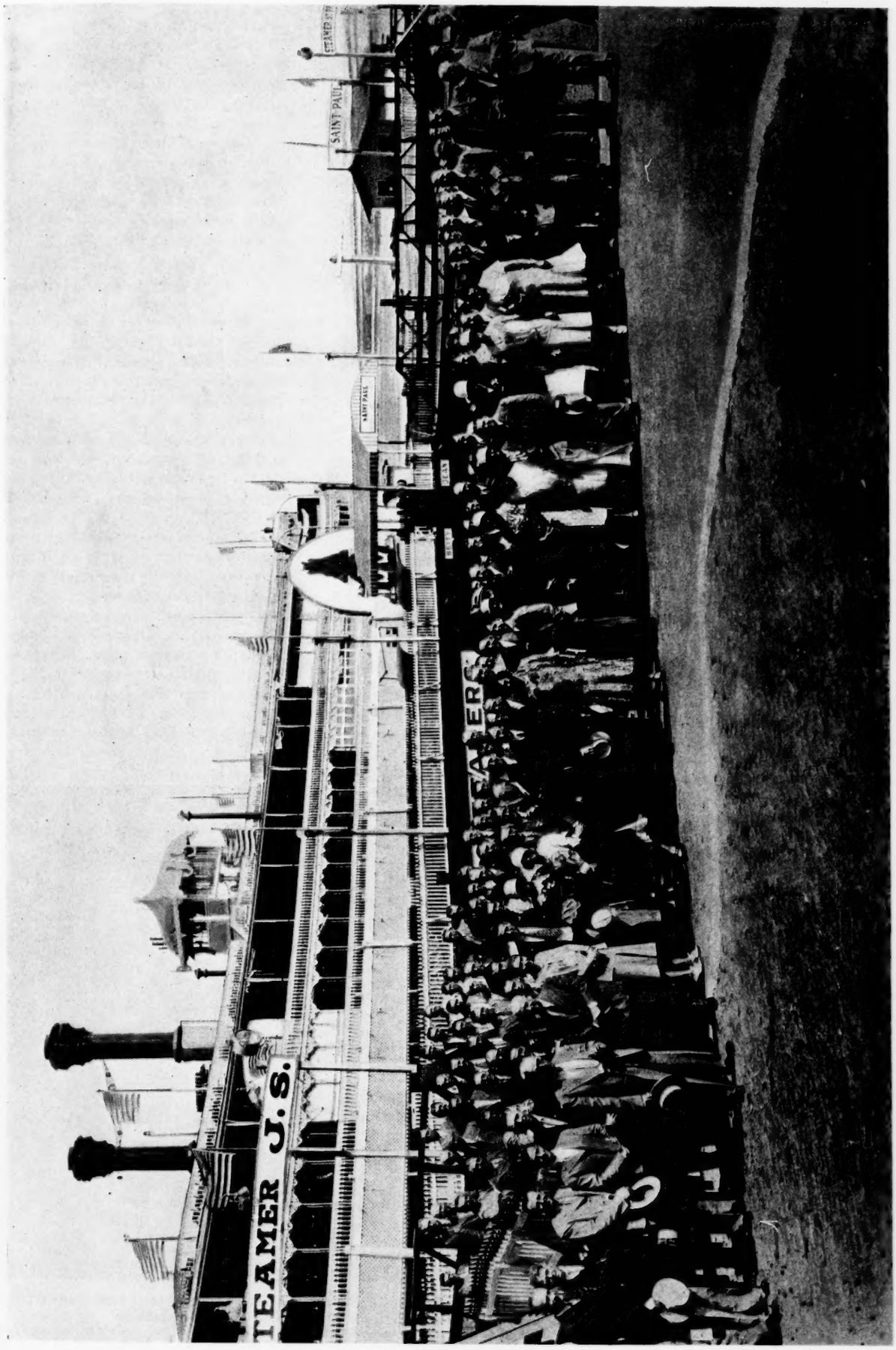
Report of Distribution Committee

Another section of this report was devoted to "Concrete Conduits for Central Heating Plants" by H. L. Flodin, of the Structural and Technical Bureau of the Portland Cement Association. Mr. Flodin's report was filled with practical suggestions for pouring concrete conduits, gained from the extensive research of the Portland Cement Association. When his paper is published in the Proceedings it will include a number of charts indicating the importance of such factors as the influence of the water-cement ratio and the extent of curing on the permeability of concrete, the relation between water-cement ratio and compressive strength at 28 days, manhole construction and a design for reducing form work to a minimum.

"Common Brick and Its Applications to Steam Main Conduit Construction," was presented by R. B. Perry, of the Common Brick Manufacturers' Association. Mr. Perry gave some impressive figures and facts as to the durability of



Sketch Submitted by R. B. Perry for Reinforced Brick Conduit for Steam Lines



National District Heating Association Convention Party About to Board the Mississippi Steamer J. S., during the Annual Meeting of the Association, St. Louis, June 3-5

Detail of Manhole, Showing Anchorage for Expansion Joint, Using Anchor Lug Built Into the Manhole Walls

brick construction. He also quoted from the experiments reported in the A.S.H.V.E. *Guide* indicating that hollow brick filled with flake gypsum was found to be the most effective with regard to the transmission of heat, as compared with concrete, solid brick, hollow brick, and a combination of concrete and tile.

Mr. Perry also presented a sketch of a brick construction which, he felt, offered a number of desirable features which should lend itself to economical fabrication, installation and maintenance.

E. J. Russell, chairman of the City Planning Commission of St. Louis and a director of the Citizens' Smoke Abatement League of St. Louis, addressed the convention on "Central District Steam Service—An Aid to City Development." Mr. Russell spoke particularly of the smoke problem in St. Louis, which, he said, now was costing the people of that city $17 per person per annum. Heating units, he declared are largely responsible for this smoke, as evidenced by a comparison of winter and summer conditions. He expressed his belief that district heating was a solution of the smoke problem and urged an extension of district heating plants generally and in St. Louis in particular.

With the Manufacturers

In addition to displays on the part of several of the manufacturers present, special interest centered in the construction, on a lot directly across the way from the Coronado Hotel, of a life-size section of Adsco underground pipe construction, including manhole, insulation and expansion joints.

Other manufacturers who exhibited equipment were: Central Station Steam Co., Detroit, Mich., Cadillac demand contactor attachment; Builder's Iron Foundry, Providence, R. I., shunt meter; C. E. Squires Co., Cleveland, O., Squires reducing valve; Barber-Colman Co., Rockford, Ill., temperature control system.

Convention Delegates Enjoy Sights of St. Louis

Under delightful weather conditions and with an entertainment program which filled every idle moment, no stone was left unturned by the local entertainment committee, headed by J. E. Hillemeyer, of the Union Electric Light & Power Company, to add to the pleasure of the occasion. One of the principal events was a boat trip on the afternoon of June 4 down the Mississippi River on the typical river boat J. S. The same evening the entire party were taken to the municipal open-air theatre where they attended the opera "Nina Rosa." The following afternoon was given over to golf at the Westborough Country Club.

At the annual banquet of the association, Thursday evening, June 5, at the Hotel Coronado, the committee provided an elaborate entertainment between courses and following the dinner, including the notable feature of a demonstration by "Doctor McNamara of Johns Hopkins University" who, it was stated, happened to be in St. Louis at the time and was prepared to give a demonstration based on recent research in the field of radio activity. After putting a number of the officers and members of the association through their paces in subjecting themselves to instruments for reading their thoughts and in other ways determining their mental characteristics, it finally was disclosed in the face of rapidly-accumulating evidence that the whole affair was a "fake," for which the chairman of the entertainment committee received his full share of abuse, and this went also for his co-conspirator, Hal. C. Kimbrough, of the American District Steam Company.

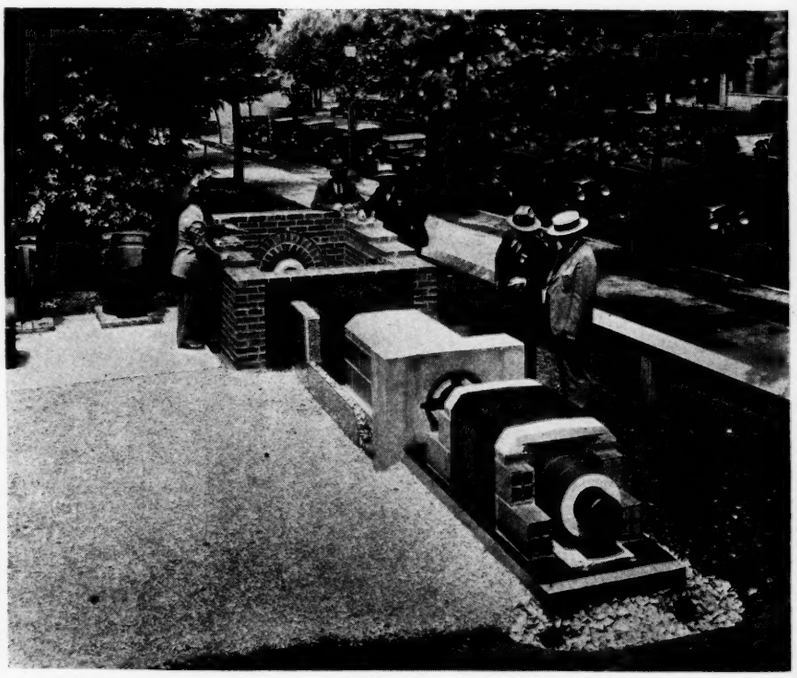


Exhibit of Multicell Tile Conduit Construction at the St. Louis Convention of the National District Heating Association

Showing Method of Installing Drainage Tile, Waterproofing and Provision for Taking Care of Expansion of Tile Conduit through Waterproofed Manhole Wall. Insta'lation also Included Alignment Guides and Roller Guides under the Pipe.

Heating Engineers Visit the Northwest

NEW applications of air conditioning to hospital treatment, significant data showing, among other things, how cold walls affect comfort even with 70° indoor temperatures, the effect of air velocities and character of surface on surface conductances, together with conclusive tests proving that air infiltration through wood frame building constructon is a negligible item, were some of the high spots at the summer meeting of the American Society of Heating and Ventilating Engineers, held in Minneapolis, Minn., June 24-27. To those interested in water heating work, the data giving results of tests on loss of head in submerged orifices was presented in practical form, making it possible to regulate the friction in a pipe line when the velocity is known or to determine the velocity and, consequently, also the quantity of water flowing through the orifice.

Individual thermostatic control of radiators came in for a surprising amount of discussion, particularly on the part of those connected with district heating work, who saw in this method an increased use of steam due to the prevalent practice of opening windows to cool overheated rooms.

It was the first time the society had ever visited the Northwest and members of the Minnesota Chapter, who acted as hosts, saw to it that their guests were royally entertained during their stay in the Flour City. Extensive drives through the city's park system and around the attractive lakes within the city itself were a revelation to those not familiar with the beauties of Minneapolis, and it was noticed that many forsook the pleasures of golf to take a dip in Lake Calhoun, which was but a few minutes' ride from the hotel.

A novel feature of the meeting, indicating the enterprise of the Minnesota Chapter, was the publication of a convention daily in the form of mimeographed typewritten sheets giving the interesting news of the meeting. A sign of the times was to be noted in the fact that several of the delegates, including Warren Webster, Jr., of Camden, N. J., and Homer Linn, of Chicago, travelled to Minneapolis from Chicago by air.

Prof. F. B. Rowley, of Minneapolis, who, with Mrs. Rowley, flew to Minneapolis from Breezy Point Lodge in his airplane, took up a number of the visitors for short spins above the city.

Nominations of new officers, announced at the concluding session, were:

For president, Willis H. Carrier, president of the Carrier Engineering Corp., Newark, N. J.; for vice-president, Prof. F. B. Rowley, University of Minnesota, Minneapolis, Minn.; for second vice-president, W. T. Jones, Barnes & Jones, Boston, Mass.; for treasurer, Frederick W. Mensing, Philadelphia, Pa.; for members of the council (three-year term) E. K. Campbell, Kansas City, Mo.; Prof. E. O. Eastwood, University of Washington, Seattle, Wash.; E. Holt Gurney, Toronto, Ont.; and Russell Farnham, Buffalo Forge Co., Buffalo, N. Y.; for member of the council to fill the unexpired term of Alfred Kellogg, of Boston (resigned), Davis S. Boyden, of Boston.

Announcement was made of the formation of a new chapter in Los Angeles, to be known as the Southern California Chapter.

Although not announced officially it was understood that the annual meeting will be held in Pittsburgh the last week in January, 1931, with headquarters at the William Penn Hotel. Boston has been chosen for next summer's meeting, and Cleveland for the winter meeting, in January, 1932, which will be held in conjunction with the Second International Heating and Ventilating Exposition in the same city.

Morning Session, June 24

After passing through one of the summer's most intense heat waves, on the way to Minneapolis, the convention party was greeted by clear skies and a welcome relief from the heat as the opening session was called to order by L. A. Harding, Tuesday morning, June 24, at the Curtis Hotel in Minneapolis.

President E. A. Jones, of the Minnesota Chapter, extended the greetings of Minnesota. He then introduced Mayor Kunze, of Minneapolis, who welcomed the delegates to the Twin Cities.

Due to the absence of Prof. A. C. Willard, the report of the Committee on Meeting Programs was put over.

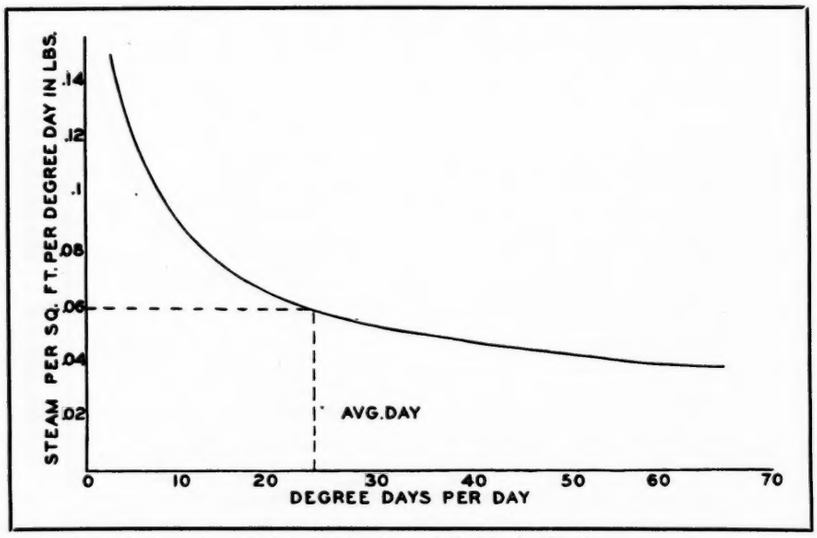
The two technical papers at this session were "Control Equipment for Gas-Burning Heating Appliances," by W. E. Stark, and "Economic Use of Steam in Modern Buildings," by F. A. Gunther. Both papers aroused lively discussions.

A statement, for instance, in Mr. Gun-

Courtesy of Minneapolis Star

Convention Goers in Minneapolis

Reading from left to right: W. T. Jones, Boston; Thornton Lewis, Philadelphia; W. A. Rowe, Detroit; Miss Ruth Campbell, Kansas City; John Howatt, Chicago; President L. A. Harding, Buffalo; Secretary A. V. Hutchinson, New York.



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Typical Heating Rate Curve

ther's paper that heat consumption in a building should be based on pounds of steam per square foot of equivalent direct radiation, rather than upon per cubic foot of volume, was challenged by some of the district heating men present, as was the general idea of the use of direct control radiator valves.

Economic Use of Steam in Modern Buildings

The author, F. A. Gunther, stated that the comparison of steam consumption in large buildings should be on the basis of pounds of steam per square foot of radiation, rather than in pounds per cubic foot of volume. He suggested that, for the purpose of checking day consumptions, the operator can plot the results obtained by dividing the daily steam consumption by the number of square feet of equivalent direct radiation in use and this quantity by the number of degree-days for that particular day and plotting this amount against the number of degree days per day. The resultant average curve should be hyperbolic. He stated that there are a large number of automatic control devices, each of which has its advantages. These can be divided into two groups. First, those which control the temperature of the agent or medium of heat distribution, and, second, those which control the supply or quantity of the agent or medium. The second group can be further divided as follows:

1. Unit thermostatic control obtained through the use of one automatic thermostat controlling the supply to the entire building.
2. Automatically controlled zone system.
3. Controlling groups of radiators.
4. The single radiator control.

S. S. Sanford, of the Detroit Edison Company, made the point that installed equivalent direct radiation would be a correct basis of determining steam consumption in buildings if the ratio of installed radiation to heat loss were constant for the buildings being compared. Unfortunately, this ratio varies considerably according to the extent to which an excess of radiation is provided. This is especially true in buildings heated by indirect radiation. Where heat loss data are not available, it has been Mr. Sanford's experience that comparisons based on building volume give more consistent results than those based on installed radiation. Such comparisons should be limited to buildings in the same class, and allowance should be made for the shape of the building. Another basis of comparison is steam used per square foot of exposed surface.

With regard to automatic temperature control equipment, Mr. Sanford pointed out that any control operated by indoor temperature is affected by open windows and is subject to tampering by room occupants and, therefore, may cause the steam consumption to be higher than necessary. He believed that better economy can be obtained through fractional heating of radiators by the use of radiator orifices with the control in the hands of the operating force of the building.

For the Guide Publication Committee, Davis S. Boyden, chairman, stated that the ninth edition of the *Guide*, to be known as *The Guide* 1931, will contain 36 chapters, two of which, "Fan Steam Heating" and "By-Products in Heating" are new. The chapter on "By-Products in Heating" will include a discussion of exhaust steam heating. Some of the material from the paper, "Power from Process and Space Heating Steam," presented at the 1930 annual meeting in Philadelphia by Mr. Harding, will be incorporated in this chapter.

Chapter 2 of *The Guide* 1930 will be divided into four parts in *The Guide* 1931, three of which will be separate chapters, and the fourth of which will be a part of Chapter 34, "Special Applications of Heating and Ventilation." The chapter on "Ozone" will be eliminated and a brief discussion of this subject included in Chapter 34, as well as a discussion of ionization of air.

The two chapters designated in *The Guide* 1930 as "Air Conditioning" and "Drying" will be treated as correlated chapters in *The Guide* 1931, and will be designated as "Air Conditioning for Comfort," and "Air Conditioning for Processing and Drying." In *The Guide* 1930, the discussion of unit air conditioners and unit air coolers was included in the chapter on "Unit Heaters and Air Conditioners." In *The Guide* 1931, this discussion will be included in the "Air Conditioning" chapters. "Automatic Heat and Humidity Control" will be treated in the same chapter in *The Guide* 1931, although previously these subjects have been treated in separate chapters.

The chapter on "Air Ducts" has been expanded to include dampers, registers and grilles. Instead of treating "Pneumatic Exhaust Systems" as in Chapter 28 of *The Guide* 1930, the subjects of "Smoke, Ash and Cinder Treatment" will be treated in Chapter 33 of *The Guide* 1931, as these are considered more closely related to the industry. It is proposed to treat a number of miscellaneous phases and problems relating to heating and ventilation in the "Special Application" chapter.

As there was still some time left at this session, two of the items on the following day's program were taken up, that is, the report of the Committee on Research, Prof. F. B. Rowley, chairman, and the report of Director F. C. Houghten, of the Research Laboratory.

Professor Rowley stated, in his report, that the society's permission for the Research Laboratory to engage in commercial research or testing for allied organizations has resulted in the adoption by the Research Committee of a procedure for undertaking such work. While commercial research and testing, he said, were not made mandatory, the discussion leading up to the adoption of the new regulations emphasized the desirability of the laboratory's engaging in such work under proper conditions and safeguards.

Under the new regulations governing the Research Committee, a request has been received from the Heating and Piping Contractors National Association for a program of testing and rating of various types of radiation. Acting upon this request, the Committee on Heat Transmission has outlined a method of

test procedure and estimated the approximate cost for the work. This report has been submitted to the Heating and Piping Contractors National Association, and as soon as approved by them, the necessary arrangements will be made for doing the work.

Among the investigations now in the hands of sub-committees are those on air cleaning devices, O. W. Armspach, chairman; air conditions and their relation to health, W. H. Carrier, chairman; atmospheric dust and smoke, A. S. Langsdorf, chairman; garage ventilation, E. K. Campbell, chairman; heat transmission, A. E. Stacey, chairman; oil-burning devices, L. E. Seeley, chairman; pipe sizes for heating systems, H. M. Hart, chairman.

Projects under investigation at the Reseach Laboratory, Pittsburgh, and at the various cooperating institutions include:

I. Air Conditions and Their Relation to Health.

II. Heat Transmission.
- (a) With reference to built-up wall construction (University of Minnesota).
- (b) Effect of ageing on the conductivity of concrete (Pittsburgh).
- (c) Heat absorbed from Solar Radiation (Pittsburgh).
- (d) Use of the Nicholls heat flow meter.

III. Infiltration of Air Through Walls.
- (a) Tests to determine leakage through various types of walls (University of Wisconsin).
- (b) A study of the "drift" of air across buildings (University of Wisconsin).

IV. Pipe Sizes for Steam Heating Systems.
- (a) Capacity of pipes for various parts of a hot water heating system (Texas Agricultural and Mechanical College).
- (b) Capacity of pipe for various parts of a steam heating system (by Research Laboratory at Carnegie Institute of Technology).
- (c) Study of the use of copper and brass pipe in steam and hot water heating (plans under way).

V. Air-Cleaning Devices.

A study of methods for determining the amount of dust in air.

VI. Radiation.
- (a) Plans under way for determining the heat output from various types of radiation (Pittsburgh).
- (b) A study of heat distribution from different types of radiation.
- (c) Determination of proper method of testing radiators (Purdue).

VII. Garage Ventilation.
- (a) A study of conditions at Washington University (by Dean Langsdorf).

VIII. Oil-Burning Devices.
- (a) A study of the operation and method of test (Yale University, Professor Seeley).

IX. Atmospheric Dust and Smoke.

A study in cooperation with U. S. Weather Bureau and public health departments of various cities.

X. Measurement of Air Flow Through Registers and Grilles (with Armour Institute, Professor Davies).

XI. A Study of Thermal Properties of Different Species of Wood (in cooperation with National Lumber Manufacturers Association).

Morning Session, June 25

Wednesday morning's session was given over entirely to the presentation and discussion of technical papers, including one presented by Prof. A. P. Kratz on "Wall Surface Temperatures," by Prof. A. C. Willard and himself.

Measurements of surface coefficients for building walls have been in progress at the University of Illinois for several years and a study of the results reveals the fact that an entirly new significance attaches to the inside surface temperature of a building wall, and the difference between this temperature and the air temperature inside the building. The inside wall surface temperature not only affects personal comfort, but may be made use of for estimating the relative thermal values of various walls as actually built.

The thermal effectiveness of the walls used in a heated or cooled building is reflected in the difference in temperature which that wall maintains between the inside air temperature at the "breathing line" and the inside wall surface temperature at the same level. The paper discusses the new significance of such temperatures and presents actual original data on the subject.

The summary of results shows that:

(1) A rapid increase in the difference between air temperatures at the "breathing line" and the inner wall surface temperatures of the same level, as the outside air temperature drops.

(2) For any given outside air temperature, the inside air to surface difference in temperature increases with the outside wind velocity over the wall.

(3) At any outside air temperature, the "inner air to surface" difference in temperature is greater than the "outer surface to air" difference in temperature, except for still air conditions.

(4) For a wall exposed to actual weather conditions with wind velocities ranging from 5 to 10 mi. per hr., the ratio between the "inner air to surface" difference and the "outer surface to air" difference in temperature increases rapidly as the outside temperatures drop.

(5) The ratio between the "inner air to surface" difference and the "outer surface to air" difference in temperature increases rapidly at any given outside air temperature as the outside wind velocity increases, a fact which is recognized and allowed for in heat loss calculations by making the outside surface coefficient greater than the inside surface coefficient.

(6) Walls exposed to sun effect, especially south walls, show marked reduction in "inner air to surface" differences in temperature (improving personal comfort) for many hours during, and for some time after, periods of sunshine.

(7) On cloudy days, there is apparently very little distinction between the "inner air to surface" difference in temperature of north and south walls. The same statement applies almost equally well to the "outer surface to air" difference in temperature.

The conclusions were that:

(1) Entirely too little attention has been given to the radiation effect of the inside surfaces of exposed wall and glass on the personal comfort of the occupants of heated rooms, especially during "coldest weather."

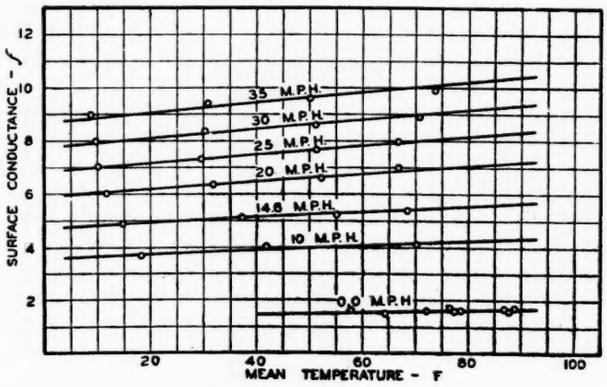
(2) Use of air temperatures at the "breathing line" alone, as the sole index of satisfactory thermal conditions for room occupancy, is crude and may result in much dissatisfaction on the part of the occupants, since they are subjected to much colder air temperatures at the "comfort line"—2 ft. 6 in. above the floor, and also the radiation effect of much colder exposed wall and glass surfaces at all levels in the room.

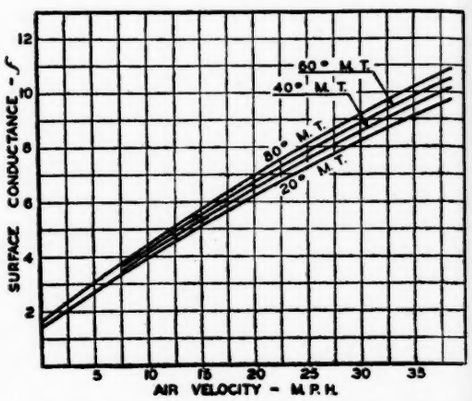
(3) The present ratio of 3:1 for the outside to inside surface coefficients used in the academic calculations of heat transmission coefficients of solid walls and glass is only valid for an inside air to outside air temperature difference of approximately 70° F. and a wind velocity of approximately 15 mi. per hr. Both air temperature difference and wind velocity affect this ratio.

(4) Unquestionably, a distinction should be made between north and south rooms having exactly the same calculated heat loss, and the same wall and glass exposure, in selecting the sizes of heating units or capacities for such rooms. The distinction should be accomplished by an addition to the heating equipment of the north room, and not by a reduction for the south room.

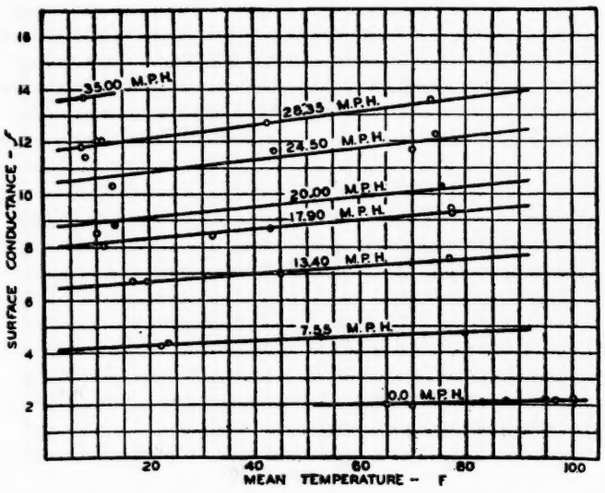
Temperature control or regulation, preferably automatic, is far more important in south rooms than in north rooms, as attempts to control an entire building from the main unit cannot be successful on sunshiny days.

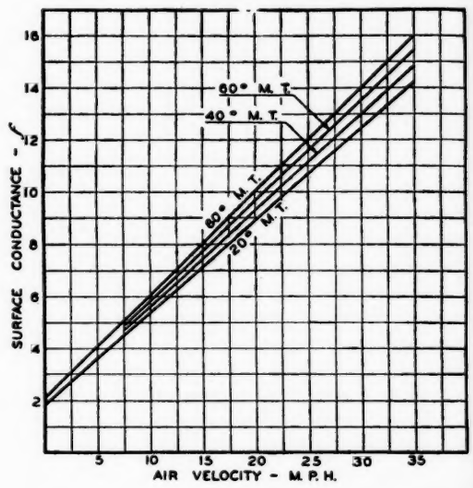
(5) The effective insulation of buildings assumes an entirely new signifi-



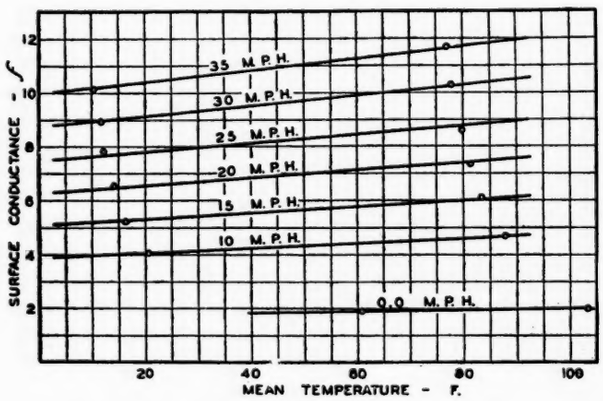


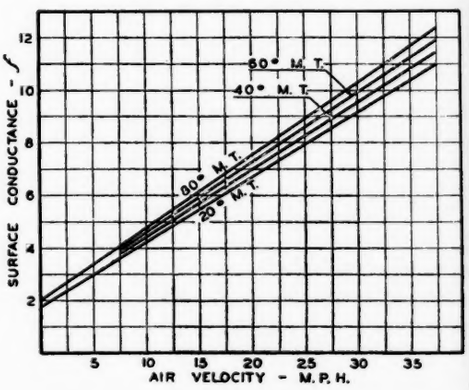
Figs. 1 and 2 Constant Velocity and Mean Temperature Curves for Glass Surface



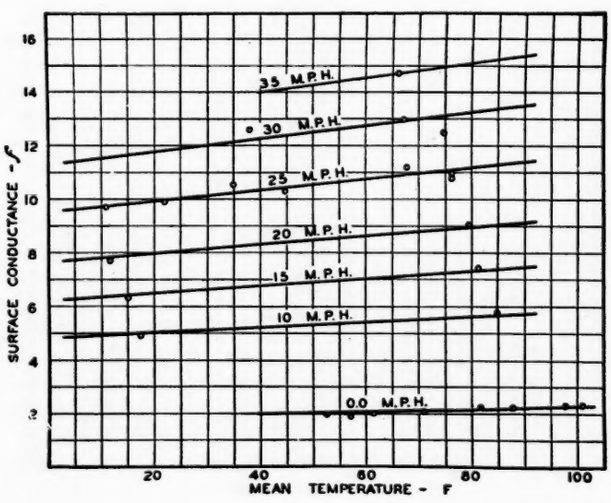


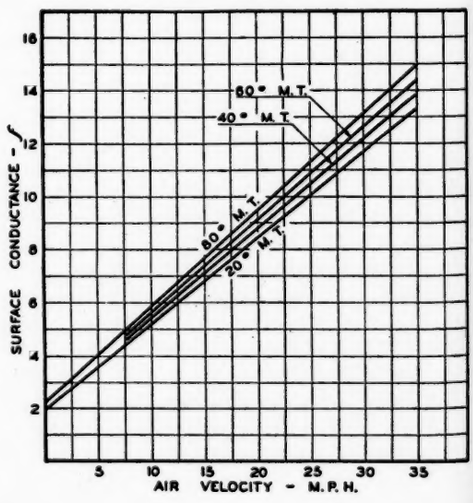
Figs. 3 and 4 Constant Velocity and Mean Temperature Curves for Brick Surface





Figs. 5 and 6 Constant Velocity and Mean Temperature Curves for Smooth Plaster Surface





Figs. 7 and 8 Constant Velocity and Mean Temperature Curves for Concrete Surface

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cance when the differences between the inside air and inside wall or glass surface temperatures for various types of wall construction and glazing are considered and compared. Effective wall and glass insulation accomplishes two things: (1) it reduces heat loss, which is obvious, but from the standpoint of the comfort of the occupants it may render a far more important service in that, (2) it increases the inside wall or glass surface temperatures very materially in severe winter weather and thereby reduces the radiation or chilling effect of the cold wall and glass surfaces on the occupant for the same breathing line air temperature in the room in both cases.

Surface Conductances as Affected by Air Velocity, Temperature and Character of Surface

This paper was prepared by Prof. F. B. Rowley, A. B. Algren and J. L. Blackshaw, all of the University of Minnesota, where the test is being carried on in cooperation with the society.

The authors stated that in making a complete analysis of the heat flow through built-up wall sections, that is, the flow of heat from air on one side of a wall to air on the other side, three points must be considered: First, the flow of heat from the air on one side of the wall to the surface on the same side, which is assumed to be the same as the flow of heat from the opposite surface to the air on its side; second, the conductance of the heat through those parts of the wall that are built up of homogeneous materials; third, the conductance of heat across air spaces within the wall. These air spaces may be of any size or shape, and there may be any number of them in the wall structure. If the laws governing these three factors are definitely known, then it is possible to calculate the heat flow through any built-up wall section, provided the characteristics of the materials used in the wall are also known.

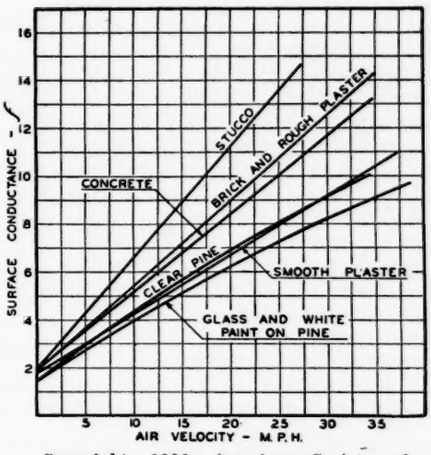

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Fig. 9. Relation Between Surface Conductances for Different Surfaces at 20° F. Mean Temperature

A primary report of this investigation was published by the society in 1929, but since then the apparatus has been remodeled and the work extended to cover nine different surfaces used in building construction.

One point which should be definitely understood is that these investigations cover air velocities parallel to the surface. The question immediately arises as to what the condition would be if the air flow were perpendicular or at some other angle to the surface. This is a point for further investigation; the relative surface effect of wind to different angles of the surface must be determined and factors obtained which can be applied to the various surface coefficients to correct for direction of air flow.

Tests were run on glass, brick, white paint on pine, smooth plaster, clear white pine, rough plaster, concrete and stucco. When plotting the surface conductances for various air velocities against mean temperatures, the authors found that the points lay on a straight line and when the lines are extended, these lines crossed the line of zero surface conductance at absolute zero mean temperature. In other words, with a total absence of heat, the surface conductance was zero.

Whether or not humidity affects surface conductance is a point to be considered. If it does, the effect is of small consequence because, although there was no provision made for keeping constant humidities in these tests, there was no appreciable variance in the results. The effect of a wet surface on the surface coefficients is also a question for further consideration.

It is significant that the results of the tests showing surface coefficients at zero velocity check closely with those which were obtained in former tests on similar materials, using the hot-box set-up for built-up wall section tests at the University of Minnesota, which set-up does not allow for any movement of air.

The concluding paper at this session was one by Paul D. Close, technical secretary of the society, supplementing that of Professors Willard and Kratz, entitled "How Comfort is Affected by Surface Temperatures and Insulation."

TEST DATA FOR SMOOTH PLASTER SURFACE

Air Velocity Miles per Hour	Test Surface	Air and Surface Temperatures Degrees F. Air Temp. 1 In. from Test Surface	M. T.	Temp. Difference	Heat Flow B.T.U. per sq. ft. per hr.	Surface Conductance, f
35.00	17.55	2.85	10.20	14.70	149.233	10.152
30.00	20.20	3.05	11.62	17.15	152.748	8.906
25.00	21.75	2.45	12.10	19.30	150.829	7.815
20.00	25.70	2.35	14.02	23.35	152.929	6.549
15.00	31.00	1.55	16.27	29.45	153.463	5.211
10.00	39.25	1.90	20.57	37.35	152.540	4.084
0.00	86.45	34.85	60.65	51.60	99.089	1.920
35.00	83.25	70.60	76.92	12.65	148.285	11.722
30.00	84.95	70.50	77.72	14.45	149.150	10.329
25.00	88.45	71.05	79.75	17.40	150.489	8.648
20.00	91.50	71.25	81.38	20.25	149.863	7.400
15.00	95.60	71.30	83.45	24.30	150.028	6.173
10.00	103.40	72.30	87.85	31.10	147.308	4.737
0.00	126.15	80.35	103.25	45.80	92.594	2.022

Morning Session, June 26

At Thursday morning's session a report of the committee on Oil-Burning Devices, L. E. Seeley, chairman, referred to the test procedure which had been developed, comprising seven types of tests for each combination of boiler and oil burner. The testing work is now 60% completed. Work will be resumed in the fall and is expected to reveal the operating characteristics of various types of oil burners and boilers.

Incidental to the program of testing is the method of conducting a test, making measurements, etc. This eventually, stated the committee, will call for a test code suitable for a combination of an oil burner and a heating boiler.

Papers presented included:

"Capacity of Return Mains for Gravity and Vacuum Steam Heating Systems," by Director F. C. Houghten and Carl Gutberlet, which embodied the scheduled report of the Committee on Pipe Sizes for Heating Systems, H. M. Hart, chairman.

"Loss of Head in Submerged Orifices," by Dr. F. E. Giesecke.

Mr. Houghten, in his paper, gave test results on a 1-in. dry return main at the Carnegie Institute of Technology where the test set-up included a 22-ft. return riser and a 540-ft. dry return main. The paper contained capacity tables of 1-in. dry return mains for various rates of air elimination, which, however, were offered for comparison and not necessarily for adoption at this time.

Air Infiltration Through Various Types of Wood Frame Construction

For the purpose of determining the relative air tightness of various types of building construction, the program of cooperative research has been under way for the past three years at the University of Wisconsin in cooperation with the society. In the summer of 1929, work was begun on a series of tests pertaining primarily to wood frame construction under a cooperative agreement between the society, the university and the National Lumber Manufacturers' Association. It is the results of the latter program with which this paper by G. L. Larson, D. W. Nelson and C. Braatz is concerned.

The description of the test panels and the summary of results include the air infiltration in cubic feet per hour per square foot of wall under various wind velocities between 10 and 30 mi. per hr. The table below gives these data at a wind velocity of 15 mi. per hr.

DESCRIPTION OF TEST PANELS AND PARTIAL SUMMARY OF RESULTS OF AIR INFILTRATION TESTS

Panel No.	DESCRIPTION OF CONSTRUCTION Sheathing	Bldg. Paper	Siding	Air Infiltration Cu. Ft. per Hr. per Sq. Ft. of Wall. Wind Velocity 15 Mi. per Hr.
1A	1 x 6 Green Dressed and Side Matched No. 1 Common	None	None	81.2
1A1	As in 1A except knot hole plugged	None	None	78.6
1B	1x6 Air Dried Butt-Edged No. 1 Common	Bldg. Paper B	1 x 10 Bevel Siding Air Dried	0.28
1B1	As in 1B	As in 1B	Paint Added to Siding in 1B	0.18
1C	As in 1B	As in 1B	As in 1B1 (inside construction wood lath and 3 coats gypsum plaster)	0.16
1D	1 x 6 Air Dried Dressed and Side Matched No. 1 Common	None	¾ x 2 Expanded Metal 1⅛ in. 3 Coats Stucco	0.08
2A	1 x 6 Air Dried Dressed and Side Matched No. 1 Common	None	None	15.3
2B	As in 2A	Bldg. Paper A	1 x 6 Drop Siding Air Dried	0.28
2B1	As in 2A	As in 2B	Paint Added to Siding in 2B	0.27
3A	1 x 6 Air Dried Dressed and Side Matched No. 1 Common	None	None	9.3
3B	As in 3A	Bldg. Paper A	1 x 6 Bevel Siding Air Dried	0.28
3B1	As in 3A	As in 3B	Paint Added to Siding in 3B	0.11
3C	1 x 4 Boards on 5 in. Centers No. 2 Common	None	5/2-16 in. Red Cedar Shingles—5 in. Exposed	69.5
3D	As in 3C	Bldg. Paper B	As in 3C	0.38
4A	1 x 6 Air Dried Dressed and End and Side Matched No. 1 Common	Bldg. Paper A Studs Vertical	None	0.31
4A1	As in 4A	Cut Out	None	80.13
4B	1 x 8 Air Dried Ship-lap No. 2 Common	None	5/2-16 in. Red Cedar Shingles—5 in. Exposed	15.3
4D	None	Bldg. Paper B Studs Vertical	1 x 6 Air Dried Select Drop Siding Painted	0.23
4E	None	As in 4D	As in 4D (inside construction 1 x 6 Sheathing End and Side Matched)	0.23
4F	1 x 6 Air Dried Dressed End and Side Matched No. 1 Common	None	None	28.3
6A	Insulation A Sheathing Board	None	None	16.1
6B	None	None	Corrugated Steel	45.4
6C	1 x 8 Air Dried Ship-lap No. 2 Common	None	24 in. Red Cedar Shingles 11 in. Exposed	43.8
6D	None	None	1 x 10 Boards—Spaced 1 x 4 Battens—Paint	86.9
7A	Insulation B Sheathing Board	None	None	9.1
7B	1 x 6 Boards on 11 in. Centers No. 2 Common	None	24 in. Red Cedar Shingles 11 in. Exposed	122.5
7C	As in 7B	Bldg. Paper B	As in 7B	0.13
7D	1 x 6 Air Dried Ship-lap	Bldg. Paper B	5/2-16 in. Red Cedar Shingles 7½ in. Exposed	0.17
7E	As in 7D	As in 7D	As in 7D (inside construction Wood Lath and 3 Coats Gypsum Plaster)	0.12
9A	None	None	None (inside construction Wood Lath and 3 Coats Gypsum Plaster)	0.17
9B	None	None	None (inside construction As in 9A Plus Decorative Paper)	0.10
9D	None	None	Insulation A Lath and Stucco	0.39
9E	1 x 6 Air Dried End and Side Matched No. 1 Common	None	None	28.3
9F	As in 9E	Poor Grade Resin	None	2.9
9G	As in 9E	As in 9F	1 x 6 Drop Siding Painted	0.10
10A	None	None	None (inside construction Metal Lath and 3 Coats Gypsum Plaster)	0.23
10B	None	None	None (inside construction As in 10A Plus Sizing and Flat Paint)	0
10C	None	None	None (inside construction 1 x 6 Sheathing End and Side Matched)	48.8
10D	None	None	Corrugated Steel (inside construction As in 10C)	8.1
10E	None	None	As in 10D	9.1

Unless otherwise noted under "siding" there is no inside construction.

Abstracted from "Air Infiltration Through Various Types of Wood Frame Construction,"
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Results reported show that the air infiltration through a frame wall construction containing building paper or plaster properly applied is negligibly small.

The best application of building paper consists of the clamping of the paper between two thicknesses such as sheathing and drop siding or shingles. In a single-surfaced wall, the paper may be effectively applied vertically on the studding under the boards. Special precautions are necessary at the corner of a building or against door or window openings to make the paper effective.

While no difference has been found in the value of a high and a low grade paper on these infiltration tests, likely the good grade of paper will better maintain its efficiency against air infiltration over a period of years than will the poor grade of paper. A paper having considerable weight and strength should develop fewer defects in application than would a poor paper. The use of a poor grade of paper is particularly objectionable for a construction in which the paper is not firmly clamped between two thicknesses of material over its entire surface.

End and side matched sheathing has a somewhat greater leakage to air than has side matched sheathing. The difference is of no importance when sheathing paper is included in the construction. End and side matched sheathing presents the same desirable flat surface for application of paper as does side matched sheathing. There is no disadvantage from the infiltration standpoint to offset the advantages of the use of end and side matched sheathing on the usual building construction. With end and side matched sheathing, random lengths may be used, resulting in a saving in material and labor.

The application of building paper to single-surfaced frame walls such as are used for farm and other shelter buildings can be effectively and cheaply performed. The application of the paper vertically between the studding and the sheathing and with the laps on the studding makes a very good construction from the infiltration standpoint.

To obtain the full efficiency of a frame wall against air leakage, special care must be used at the corners of a building and against window and door openings. Building paper should be carefully wrapped around the corner so as to prevent air getting through the wall construction at this point.

In the case of bevel siding, there is the chance for air to enter at a corner construction and travel horizontally to seek out defects in the sheathing paper. This requires the careful application of the paper so as to prevent defects developing and the use of wide laps so as to bring them under the contact lines of the bevel siding. The use of a good grade of paper would be economical, due to freedom from tearing during application and the maintaining of a high degree of effectiveness throughout the life of the building.

Drop siding does not prevent spaces for air travel over the surface of the sheathing paper and very effectively holds the paper against the sheathing. Poor corner construction is a less serious factor with drop siding than with bevel siding.

Use of building paper is justified from an infiltration standpoint in any shingle roof or side wall construction. The use of ship-lap rather than spaced boards is desirable in the clamping of the sheathing paper securely over its entire surface. This minimizes the buckling of the paper from ageing. In districts where heating seasons are mild, the inclusion of building paper and the use of ship-lap rather than spaced boards would be justified by the reduction in infiltration.

Plaster by itself allows the passage of only a negligible amount of air when properly applied. Proper application means the sealing at the base-board and against window and door openings by running the plaster tightly against the floor or frame construction of an opening. The full effectiveness of plaster is probably seldom obtained. The development of cracks reduces the efficiency of the plaster. The application of paint or wall paper is not justified from the standpoint of infiltration reduction on a plaster wall that is fully effective, but on a cracked plaster surface the application of either paint or paper may reduce infiltration considerably.

The effectiveness of plaster properly applied is no justification for the use of low grade building paper or of the poor construction of the wall containing it. Not only is it difficult to secure and maintain the full effectiveness of the plaster, but also it is highly desirable to have two points of high resistance to air flow with an air space between them to keep heat transmission losses at a minimum.

Loss of Head in Submerged Orifices

In his paper "Loss of Head in Submerged Orifices," F. E. Giesecke, director, Engineering Experiment Station, Texas Agricultural and Mechanical College, stated that the loss of head in submerged central circular diaphragm orifices in pipes varies with the size of the pipe and with the ratio of the pipe diameter to the orifice diameter, and slightly with the velocity of the water.

The author concluded that the losses can be accurately determined and the resulting data used to determine the velocity and consequently the quantity of water flowing through the orifice to regulate the friction in the pipe line when the velocity is normal.

The paper contains the results of tests held at Texas A. & M. to determine the losses of head caused by orifices introduced to increase the friction in a portion of the heating system to secure a balanced flow of water to the several radiators in the system. The tests were run on diaphragm orifices in a 1 in. pipe, and the results compared with tests on orifices in a ¾-in. pipe reported by the author at the summer meeting of the society in 1929. The two methods checked, and the results of both are sufficiently accurate for all practical purposes.

Finally, results were compared with those tests on circular diaphragm orifices in 4-in., 6-in. and 12-in. pipe reported by the Engineering Experiment Station, Bulletin No. 109 of the University of Illinois. The author concluded that it seems possible to determine the loss of head for any central circular orifice in any pipe with considerable accuracy by interpolation between the experimental values of these two investigations.

Final Session, June 27

Friday morning's session was devoted to the presentation of two papers, one on "Application of Air Conditioning to Premature Nurseries in Hospitals," by C. P. Yaglou, Philip Drinker and K. D. Blackfan (presented by W. H. Carrier) and one on "Carbon Monoxide Concentration in Garages," by A. S. Langsdorf and R. R. Tucker.

For the Committee on Garage Ventilation, Chairman E. K. Campbell reported that while the present codes cover bus garages and other-than-bus garages, it was the desire to combine these two codes. No change, he stated, is wanted by the insurance companies so that nothing further has been done in the matter up to the present time.

Mr. Campbell called attention to the fact that while in the the early stages of the committee's work recirculation of air was considered detrimental, such recirculation now is required, as it was found that the garage ventilation problem turns on pockets of explosive gas, rather than on the general air conditions in the garage.

Minnesota Chapter Dispenses Northwestern Hospitality

Under the general direction of Chairman A. Buenger, members of the Northwestern Chapter "put over" a program

of entertainment which sent their guests away with the happiest recollection of Minneapolis and its hospitality.

On the opening day the entire party was taken on a bus ride through the parks and past the lakes of the Twin Cities, passing Minnehaha Falls en route. At that point one facetious Minneapolis lover was prompted to remark that Minnehaha stood for Minneapolis and St. Paul, Minneapolis being "Minne" and St. Paul, "Haha."

A stop was made at the University of Minnesota Engineering Laboratory where some of the party inspected the work being conducted there, as described in papers presented at the meeting.

The party then proceeded to the plant of the Minneapolis-Honeywell Regulator Company where guides took the visitors in groups through the plant, explaining the various operations in the manufacture of the company's line of temperature and other control devices. Particular interest was shown in the oil burner and gas heater controls.

In the evening the party gathered in the ballroom of the Curtis Hotel for an informal reception and dance.

On both Wednesday and Thursday afternoons the men played golf at the Bloomington Golf Club and Minnetonka Country Club, while the ladies were entertained at the Minnetonka Automobile Club (where the men joined them at dinner Wednesday evening) and at Old Orchard on Lake Minnetonka where they spent Thursday afternoon.

All returned to Minneapolis in time to participate in the convention dinner at the Curtis Hotel, at which Dean F. Paul Anderson presided as toastmaster. His duties, however, were light, as the only scheduled speaker, President L. A. Harding, spoke briefly, and the room then was cleared for dancing.

In addition to the activities of the General Arrangements Committee, of which A. Buenger was chairman, other committees which shared in the success of the meeting were:

Reception Committee, Prof. F. B. Rowley, chairman; Hotel and Transportation Committee, W. F. Uhl, chairman; Entertainment Committee, H. E. Gerrish, chairman; Finance Committee, A. M. Wagner, chairman; Publicity Committee, A. J. Huck, chairman; Golf Committee, H. J. Sperzel, chairman; Ladies' and Hostesses' Committee, Mrs. F. B. Rowley, chairman.

Western New York Chapter

Western New York Chapter held its annual mid-summer dinner dance at the Automobile Club, Clarence, N. Y., Tuesday, June 17. A splendid time was reported by the seventy who were in attendance.

Houghten Addresses Wisconsin Chapter

F. C. Houghten, director of the Research Laboratory of the society, was the guest speaker at the regular monthly meeting of the Wisconsin Chapter, held at the Elks Club, Milwaukee, May 17. There were 26 members and guests in attendance. Mr. Houghten told of the origin of the Research Laboratory which is now ten years old, how the Laboratory has never tested manufactured devices for manufacturers, but that, in 1924, the code was revised to permit such testing under certain conditions. The hazards and the good resulting from such a practice were explained by Mr. Houghten and a résumé of the work done in developing the standards for ventilation were also discussed. He told about the difficulties in getting out the first *Guide* due to the differences of opinion and stated that the *Guide* is the outlet for the work of the Laboratory.

The regular monthly meeting of the Wisconsin Chapter, held June 9, which was the last one of the season until September, was in the form of a picnic at Wulf's Island, about ten miles north of Milwuakee, with 38 members and guests in attendance.

American Gas Association Issues New Edition of "House-Heating"

Prepared under the direction of the Industrial Gas Section of the American Gas Association, the third edition of "House-Heating" was recently issued. The edition contains new material, including that on degree-day data, industrial degree-days, gas conversion burners, gas-fired unit heaters, data on the heating of large buildings and the A.S.H.V.E. heat loss coefficients.

"House Heating" has run through several printings of each edition and is the standard authority on building heating in the gas industry. Although written especially for the house-heating engineer of the utility companies, the book is popular with architects and heating engineers who are in any way interested in heating with gas. Data from a large number of installations from various sections of the country have been analyzed to make possible the presentation of valuable unit fuel consumption figures for different types of heating systems, information not readily available for any other type of fuel. The book is ably edited by C. George Segeler, technical editor of the association.

Size 9 in. x 11 in. Pp. 136. The regular price of the book is $3, but responsible contractors, architects, engineers and manufacturers can probably obtain the book at a lower price through their local gas company which is a member of the association. Published by the American Gas Association, or can be secured from the Book Department, HEATING AND VENTILATING, 521 Fifth Ave., New York.

Frost Laboratory Doing Special Work on Anthracite Burners

The Frost Research Laboratory recently discontinued its work with the Anthracite Operators and now is conducting research on anthracite and coke burners and stokers for manufacturers, in addition to rating tests on coal, gas and oil-burning boilers, and cast-iron and extended surface type radiators, and unit heaters. It has recently started upon a special research program on anthracite, having engaged for this work the services for the summer of Prof. H. G. Turner of Lehigh University, the leading authority in America on the structural composition of anthracite.

The work of the laboratory is converging more and more upon specialized research in the heating field. It has assisted in the development of three successful anthracite stokers of the fully automatic type. Within the last few months it has worked upon the redesign of a gas boiler so that the redesigned boiler was able to meet the requirements of the American Gas Association without alteration.

Another recent work of the laboratory was a series of rating tests on a complete line of oil-burning steel boilers. This work is of interest because it represents the first published performance data on a line of steel boilers tested under the new Code of the A.S.H.V.E., and is the first of the kind to be used in determining approved ratings by the Heating and Piping Contractors National Association.

Gas May Be Sold on Heat Content Basis in Chicago

A new schedule of rates has been filed with the Illinois Commerce Commission by The Peoples Gas Light and Coke Company of Chicago by which customers would have the option of being charged either on the therm, or heating value, basis or on the cubic foot basis. The new schedule is proposed to become effective July 15, but may be suspended pending investigation by the commission, it was stated.

According to an announcement, all gas companies in Illinois are charging customers on the cubic foot basis, and the Chicago gas company is the first to propose the therm basis in that state.

Correspondence

Do Unit Heaters Require Additional Boiler Capacity?

EDITOR HEATING AND VENTILATING:

In the May issue of HEATING AND VENTILATING, in connection with an article by the Trouble Engineer captioned "Unit Heaters Pull Water Out of Boilers," he states: "I have established a rule that any unit heater installation must have a boiler of 100% greater capacity than the amount of radiation installed in order to obtain satisfactory and lasting results under all weather conditions." I wish to take issue with this statement.

I have no specific data on the building referred to and cannot, therefore, make heat loss calculations and determine how much radiation is required, but I estimate roughly that a four-story loft building having plan dimensions of 105 ft. x 52 ft. would require somewhere in the neighborhood of 5000 sq. ft. of direct radiation.

There were two unit heaters installed on the second floor, each having an air capacity of 3500 c.f.m., or a combined air capacity for the two units of 7000 c.f.m. An inside temperature of 72° F. is specified. Assuming that the minimum outside temperature is zero, it would require 548,000 B.T.U. per hr. to heat this 7000 c.f.m. from outside temperature to room temperature. This heat is in no way available toward heating the building, but merely brings the air introduced from outdoors from outside temperature to room temperature. Any heat required to counteract the direct losses through the windows, walls, etc., must be in addition to this 548,000 B.T.U.

Converted into boiler load, this heat required for the incoming air is equivalent to 2280 sq. ft. of direct radiation, which approximates a 50% increase to the writer's estimate of 5000 sq. ft. of direct radiation required for the building without ventilation. It is only to be expected, then, that a boiler sized for the original job, which included no ventilation, would be under capacity when ventilation was added.

The Trouble Engineer makes the statement that the unit heaters condersed more steam at starting and for several hours afterwards, than four times the equivalent amount of direct radiation. By this he presumably means that the coil in each unit, which contained 162 sq. ft. of heating surface, condensed the same amount of steam as 650 or 700 sq. ft. of direct radiation. This is to be expected since the fans in the unit heater draw the air across the coils at a high velocity. In fact, many unit heaters have a higher ratio than four to one. He neglected to state, however, that direct radiation condenses more steam per square foot when operating in rooms at lower temperatures or when heating up a room; that is, the rate of condensation for direct radiation varies in approximately the same proportion as does the rate of condensation from a unit heater for variations in air temperature.

A point not to be overlooked is that a pound of steam, in being condensed, delivers the same amount of heat when condensed in a unit heater as when condensed in a direct radiator. In most cases, especially in large buildings, the unit heater more effectively distributes the heat and in this way requires less steam than direct radiation. On the job described by the Trouble Engineer, the excess steam required must necessarily have been due to the ventilation load for, as just stated, steam cannot be condensed without delivering a definite quantity of heat, and, if no outside air were introduced, the heat from the steam condensed was all available toward heating the building.

I know a number of jobs where direct radiation has been replaced with unit heaters and where authoritative records show that the fuel saving with units is from 10% to 30%. If the substitution of units for direct radiation saves fuel (and it unquestionably does) there is certainly no ground for the statement that any unit heater installation requires more boiler capacity than a direct radiation job.

In a number of cases, the replacing of direct radiation with unit heaters has saved the installation of additional boiler capacity. One case in particular comes to mind. This is a building in which direct radiation was installed, and in severe weather it was necessary to turn off the radiation in little-used portions of the building in order to get sufficient steam to the remainder of the plant. One heating engineer had recommended additional boiler capacity to overcome this trouble. Instead of following this recommendation, however, the owner decided to install high-velocity floor-mounted unit heaters. With the unit heaters he now has ample heat throughout his entire plant in the severest weather without having to force the boiler. This is the same boiler that was inadequate for the direct radiation even with a portion of the radiation shut off in extreme weather.

Any boiler that is adequate for a system of direct radiation will have ample capacity for unit heaters, provided, of course, the units are of the proper size and all conditions are the same, and provided, further, that the unit heaters are not drawing air from outside or are expected to heat to a higher temperature.

C. D. GRAHAM, Service Mgr.
York Heating & Ventilating Corp.
Philadelphia, Pa.

We are glad to have the opportunity of correcting a mistake often made in installations of floor-type unit heaters when connected with direct radiation in factories; namely, the use of a boiler of a rating corresponding to the figured radiation or only slightly larger. While under favorable conditions this may work out fairly well, it does not give satisfactory results under severe factory conditions.

The A.S.H.V.E. Code of Minimum Requirements calls for a boiler capacity of 65% above normal load on heating systems requiring up to 100,000 B.T.U. per hr. and 60% for systems requiring 200,000 B.T.U. per hr. on low-pressure steam and hot water installations.

In the past we always have added 40% or even 60% to the old boiler ratings for direct radiation and in all instances satisfactory results were obtained. On any heating system, not fired during the night, when the fire is banked at 6 P.M. or 7 P.M., as is the case in a large number of factories where no night watchman is employed, a boiler capacity of from 60% to 100% above actual requirements is the best investment, properly to take care of the increased boiler starting load during the morning hours, when all the floors are cold.

Regarding our correspondent's statement that the heating load naturally is greater using fresh air, we have never attempted to open the fresh air intake damper until the temperature of the floors reached 60° or 65°, and then, in most cases, only part way to keep the air pure. The trouble explained in the May issue, Page 95, was encountered while the fresh air duct was closed.

In our experience we have found that for work as described in the article the cost of a 100% over-capacity boiler is repaid in two or three heating seasons by the saving of coal.

We agree with our correspondent that there are many cases where a boiler, sufficient'y large for direct radiation, will serve a unit heater installation well; in fact, in some instances may save fuel. We have such jobs working under very favorable conditions, but not in factory buildings where the fire is banked at 6 P.M., as explained in the article, and started at 6 A.M., the unit heaters being inoperative during the night.

Some unit heaters installed on vacuum heating systems are functioning well with only slight increases in boiler

capacity and, in some cases, none at all, but all of those that have come to the writer's attention, had to be fired much harder during peak starting-hour loads than other jobs where extra boiler capacity was provided. This resulted in an increase of the flue temperature ranging from 150° to 220°. It surely is uneconomical to operate a heating boiler under forced conditions like the one described above and such a layout is by no means a recommendation to the engineer or heating contractor installing same.

With increased boiler capacity, the forming of a partial vacuum, preventing the condensation from returning promptly, is eliminated and with it a problem that has caused many burned boiler sections.

THE TROUBLE ENGINEER.

Economies of Hot Water Supply

EDITOR HEATING AND VENTILATING:

We have seriously considered making a change in our system of heating hot water that is used for bath, drug store and cafeteria throughout the year.

At present we are using indirect heating. During the summer months we have to light off a 180 H.P. boiler to heat 3000 gal. of water at one time. This operation is performed three times each day that heat is not used in the building.

Would it be less expensive to have a small boiler to heat the hot water the year around? Would it be cheaper to heat with a small boiler during the summer months and then through the present system during the heating season? Or, would it be cheaper to heat with the present system the year around?

The plant operates on low-pressure and we are burning 18°-20° oil.

Chicago, Ill. D. T. D.

To give a precise, intelligent answer to this question would require more information on the subject.

The ratio of the heating radiation in the building to the amount of water heated per hour, and also their relationship to the size of the storage tank, is often a big factor in the design and sizing of the boilers.

It is stated that it is necessary to heat 3000 gal. of water at one time, and that this operation is necessary three times each day. From the nature of this type of building we infer that the heating of these 3000 gal. is necessary for different groups and that the time intervening between these classes is of 3 or 4 hrs. duration. Assuming a 4-hr. period to heat the 3000 gal., this could be accomplished with a smaller installation burning about 55 lbs. of oil per hr. The operator could use his judgment whether the smaller installation would be cheaper than running as it is now with the 180 H.P. boiler, as no doubt he has exact data on the amount of oil now being consumed under these conditions.

To heat the oil in a 1-hr. period, of course, would require an installation consuming just four times as much as that stated above. If this is the case, then the 180 H.P. equipment is not greatly in excess.

Many installations are operated in this manner using submerged coils when a much higher water heating capacity is obtained during the winter months when the heating plant is in operation and running a high boiler water temperature. During the summer time the heating system is valved off and the water heated only to a temperature sufficient to heat the domestic water without creating any steam pressure in the boiler. This, of course, gives a slower heating rate during the summer months and a large storage tank is often advisable, but this many times proves a detriment during the winter months if the sum total of the heating plant and the domestic hot water is closer to the boiler capacity. The large amount of water in the storage tank, then, has a tendency to rob the heating system.

Engineering Integrity

EDITOR HEATING AND VENTILATING:

I have just read your editorial in the June issue of HEATING AND VENTILATING and find myself very much in sympathy with the idea contained in the paragraph:

"Any appliance or method worthy of being placed on the market undoubtedly has inherent advantages which the engineer can compare with those of competing products on a sound engineering basis without distorting the facts. Any other course only leads to disrepute and the worst of it is that the manufacturer may never learn the real reason for his failure to make the desired impression."

It seems to me that the sooner this fact is clearly recognized the better off the industry in general will be. Any tendency on the part of one individual to exaggerate or to depreciate a competitor's product inevitably provokes similar excess in others. The result is generally demoralizing and tends to destroy public confidence in the whole business.

Is it not true that the sales managers and salesmen are the worst offenders in this respect, rather than the engineer? Perhaps the engineering office should keep more closely in touch with the sales force, to check up on the technical features of the advertisements and sales talks, thereby helping to maintain public confidence and to keep the industry on a sound, dignified basis.

Schenectady, N. Y. W. J. KING.

Short-Circuiting in Water Heating System

EDITOR HEATING AND VENTILATING:

Fig. 16, Part 5, of "Estimating and Designing Heating Systems," in HEATING AND VENTILATING for March, shows an isometric diagram of a water system, about which we would like to ask:

1—The size of the branch supplying the radiators for the kitchen and the maid's room is not given on the diagram, but we assume that it must be 1½ in. in order to supply the 1¼ in. and ¾ in. lines to the two radiators. This branch apparently comes from the side of the main and as a separate circuit is indicated for these two radiators, would not short circuiting of the system result?

2—As this branch is the first connection off the main and the first radiator supplied is a second floor radiator, would the system function better if the connection were taken off the lower half of the main at an angle of 45° so as slightly to check the circulation through this portion of the system?

3—The riser to the radiator in the maid's room is shown coming directly from the top of the branch. Because of the additional head of this radiator, would not the radiator in the kitchen be robbed of the proper amount of hot water?

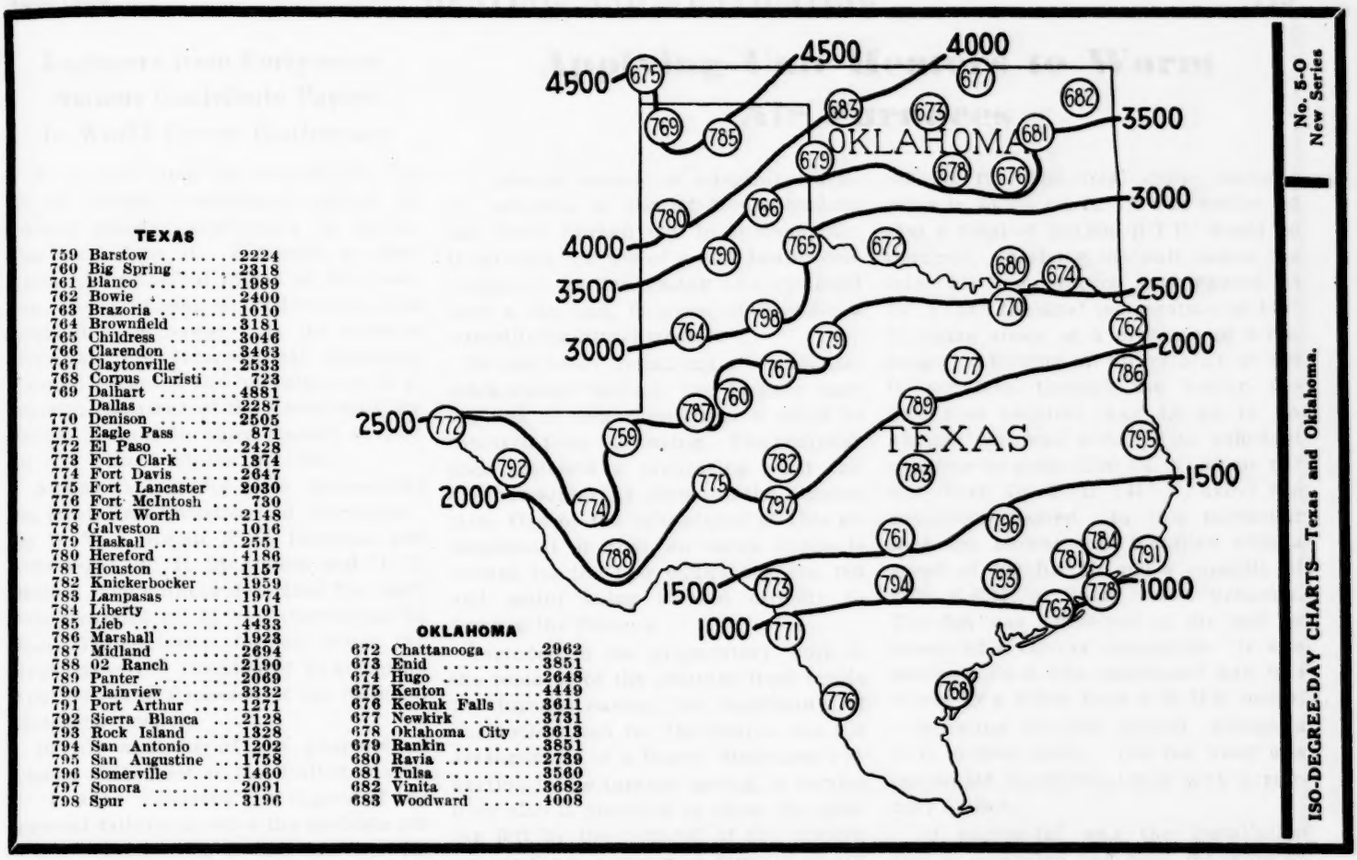
4—The branch for the two radiators mentioned above would probably be reduced before connection to the valve at the kitchen radiator, and we want to know how this reduction should be made.

New York. D. L. M.

Since the whole system is designed for a temperature drop in the radiators of 20°, each first floor radiator develops a force of 3.36 lbs. per sq. in., and the second floor radiators, 6.72 lbs. per sq. in. If the friction to each radiator is made to equal this amount, there can be no short circuit and this is the case whether the connections are made from the top or the side of the main.

The total piping to the kitchen radiator exclusive of that common to the rest of the system amounts to about 56 ft. of equivalent length after allowing for the resistances on the line with 30 ft. to the second floor risers. This gives a friction loss to the kitchen of about 3.29 lbs., and to the maid's room of 6.32 lbs. per sq. ft. when 1¼ in. pipe is used throughout to the first floor, and ¾ in. pipe for the risers and connections to the second floor.

Let us assume that a larger pipe was used to the kitchen, say, 2 in., and we can readily see from the flow chart that it would take 2000 lbs. of water flowing to create enough friction to cause a short circuit which will seriously affect the entire system.



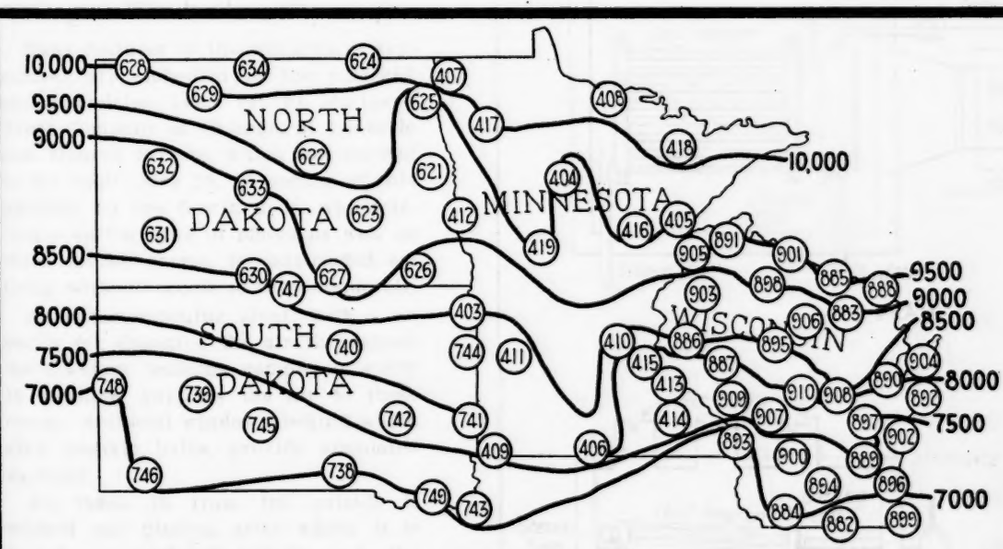
TEXAS

759	Barstow	2224
760	Big Spring	2318
761	Blanco	1989
762	Bowie	2400
763	Brazoria	1010
764	Brownfield	3181
765	Childress	3046
766	Clarendon	3463
767	Claytonville	2533
768	Corpus Christi	723
769	Dalhart	4881
	Dallas	2287
770	Denison	2505
771	Eagle Pass	871
772	El Paso	2428
773	Fort Clark	1374
774	Fort Davis	2647
775	Fort Lancaster	2030
776	Fort McIntosh	730
777	Fort Worth	2148
778	Galveston	1016
779	Haskall	2551
780	Hereford	4186
781	Houston	1157
782	Knickerbocker	1959
783	Lampasas	1974
784	Liberty	1101
785	Lieb	4433
786	Marshall	1923
787	Midland	2694
788	02 Ranch	2190
789	Panter	2069
790	Plainview	3332
791	Port Arthur	1271
792	Sierra Blanca	2128
793	Rock Island	1328
794	San Antonio	1202
795	San Augustine	1758
796	Somerville	1460
797	Sonora	2091
798	Spur	3196

OKLAHOMA

672	Chattanooga	2962
673	Enid	3851
674	Hugo	2648
675	Kenton	4449
676	Keokuk Falls	3611
677	Newkirk	3731
678	Oklahoma City	3613
679	Rankin	3851
680	Ravia	2739
681	Tulsa	3560
682	Vinita	3682
683	Woodward	4008

ISO-DEGREE-DAY CHARTS—Texas and Oklahoma. No. 5-O New Series



NORTH DAKOTA

	Bismarck	9150
621	Mayville	9250
622	Manfred	9746
	Minot	9694
623	Jamestown	9405
624	Hannah	10714
625	Grafton	9171
626	Forman	8898
627	Ashley	9469
628	Crosby	10087
629	Donnybrook	10002
630	Fort Yates	8520
631	New England	8971
632	Oakdale	8719
633	Washburn	9030
634	Westhope	10633

SOUTH DAKOTA

	Aberdeen	8279
738	Academy	7044
739	Dowling	7338
740	Faulkton	8259
741	Flandreau	8026
742	Forestburg	7887
743	Jefferson	8419
744	Milbank	8466
745	Murdo	7138
746	Oelrichs	7271
747	Pollock	8779
	Sioux Falls	7656
748	Spearfish	7071
749	Yankton	7144

MINNESOTA

403	Beardsley	8491
404	Cass Lake	9292
405	Duluth	9480
406	Fairmont	8448
407	Hallock	10285
408	International Falls	10181
409	Luverne	7915
410	Minneapolis	7851
411	Montevideo	8168
412	Moorhead	9315
413	Red Wing	7886
414	Rochester	8123
415	St. Paul	7925
416	Sandy Lake Dam	9620
417	Thief River Falls	10054
418	Tower	10438
419	Wadena	9621

WISCONSIN

882	Beloit	6879
883	Crandon	8975
884	Darlington	7420
885	Deerskin Dam	9786
886	Downing	8643
887	Eau Claire	7971
888	Florence	9112
889	Fond du Lac	7612
890	Green Bay	7823
891	Iron River	9202
892	Kewanee	7947
893	La Crosse	6690
894	Madison	7395
895	Medford	8562
896	Milwaukee	7372
897	Oshkosh	7506
898	Park Falls	9118
899	Racine	6761
900	Reedsburg	7278
901	Rest Lake	9419
902	Sheboygan	7388
903	Spooner	8757
904	Sturgeon Bay	8193
905	Superior	9750
906	Tomahawk	8658
907	Valley Junction	7919
908	Waupaca	8493
909	Whitehall	7850
910	Wisconsin Rapids	8026

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Heating and Ventilating's Data Sheets Nos. 5-N and 5-O

Heating and Ventilating's Data Sheets Nos. 5-N and 5-O

Engineers from Forty-seven Nations Contribute Papers to World Power Conference

With over 4000 in attendance, the World Power Conference opened its second plenary conference in Berlin, Germany, June 16. Economic in character, the principal theme of the meeting was problems of distribution and utilization of power. At its meeting June 12, the International Executive Council accepted the invitation of O. C. Merrill, chairman of the American Committee, to hold its third plenary session in the United States in 1936.

Among the reports were "Researches on Heat Transmission and Insulation," by W. V. A. Kemp, R. H. Heilman, and Professors W. H. McAdams and H. C. Hottel. The authors described the work being carried on by the Committee on Heat Transmission formed under the auspices of the Division of Engineering and Industrial Research of the National Research Council.

In his analysis of the progress of smoke abatement in the United States, V. J. Azbe discussed the causes of the general failure to solve the problem for whole communities in this country. He stated that there has been too much compromising and that the aim should be toward the complete elimination of the evil. Among other things, he advocated the use of automatic underfeeding devices in large heating boilers.

Chicago's Windowless Skyscraper

Many features of the windowless skyscraper are embodied in the enlarged and remodeled home of the Northern Trust Company of Chicago, at La Salle and Monroe Streets, which was opened to the public May 19. A section of this building on the fourth floor, which includes entire rows of offices as well as three dining rooms, is constructed entirely without access to the outside air.

An air-conditioning plant, with a capacity for changing the air throughout the six-story building completely every 10 minutes, supplies the air to these rooms. Artificial windows, behind which glow electric bulbs, provide simulated daylight.

Air taken in from the outside is washed and filtered, after which it is cooled or heated before delivery to the systems. One of the advantages of the lack of windows is that there is an absence of the constantly-increasing roar of city noises, permitting more concentration during working hours. To aid in the reduction of noise, the Northern Trust building is equipped with special sound-deadening ceilings which shorten voice ranges and with a carefully devised desk-spacing plan.

Applying Unit Heaters to Warm Air Furnaces

A unique method of adapting warm-air furnaces to district steam heating has been worked out in Indianapolis. It involves the use of a unit heater connected to the fan casing and equipped with a fan and, in some cases, with a humidifying attachment.

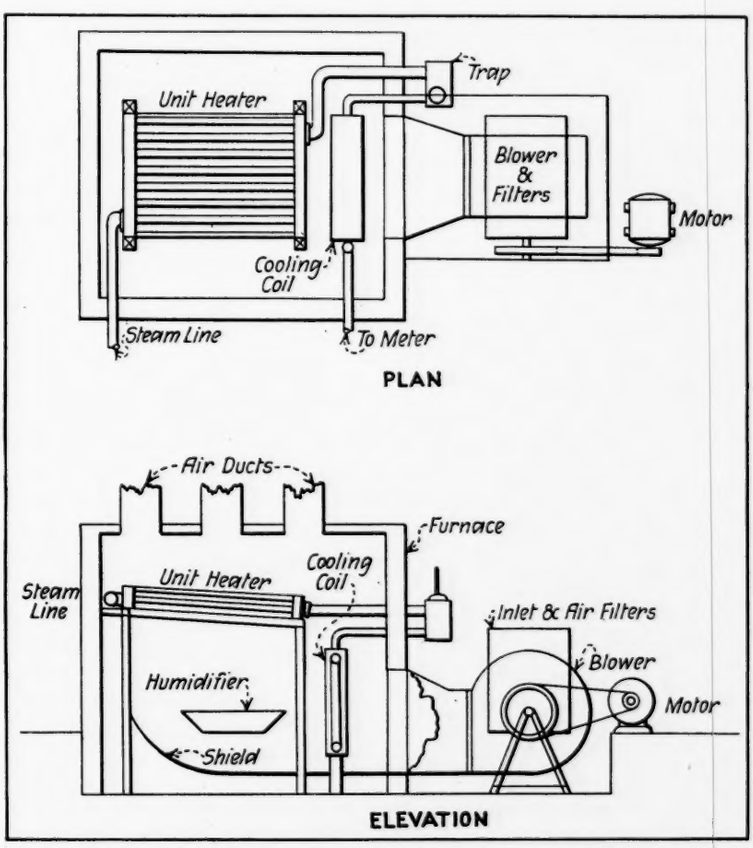
In one home containing a rectangular brick-walled furnace, the furnace casting was so constructed that it could be removed from the casing. The company then installed a preheating blast coil and humidifier, as shown in the illustration. One of the advantages of this arrangement is that no extra space is needed for the new equipment, the fan and motor being located directly in front of the furnace.

Included in the preparatory work is the removal of the castings from inside the furnace casing, the installation of supporting legs for the heater and the arrangement of a blower discharge connection to the furnace casing. A service door also is provided to close the opening left by the removal of the casting. An air filter is mounted directly on top of the intake boxes of the blower, air being taken directly from the basement.

In this particular building the estimated equivalent of direct radiation was 835 sq. ft. The total cubic contents came to 33,750 cu. ft. It was estimated that a total of 200,000 B.T.U. would be required. In sizing the unit heater the inlet air temperature was figured at 70° F. and the final temperature at 140° F., using steam at a pressure of 5 lbs. gauge. Allowing an air velocity of 600 ft. per min. through the heater, the face area required was 4.6 sq. ft. A heating coil was installed of sufficient capacity to raise 2700 cu. ft. of air per min. from 70° F. to 140° F. under the conditions named. In this particular case the blower was installed with a speed of 400 R.P.M. and a capacity of 2700 C.F.M. at ⅛-in. static pressure. The fan was connected to the unit by means of a canvas connection. It was mounted on a 2-in. corkboard and was driven by a V-belt from a ½ H.P. motor.

Incoming air was filtered through a 20-in. x 20-in. filter. The fan itself was controlled thermostatically with a mercury switch.

So successful was the installation that a campaign has been inaugurated by the heating department of the Indianapolis Power & Light Company to extend the company's operations to many of the city's furnace-heated homes.



Application of Unit Heater to Warm-Air Furnace, Supplied with District Steam

Degree-Days and Unit Fuel Consumption in Typical Cities for May

UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.T.U. per hr., and for radiation calculated on a basis of other than zero to 70°.

Coal is assumed as having a heat content of 12,000 B.T.U. per lb., gas, 1000 B.T.U. per cu. ft., and oil 140,000 B.T.U. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content in question.

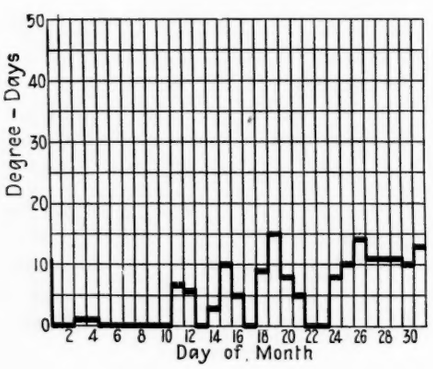
To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption, which is given for steam radiation, by 5/8.

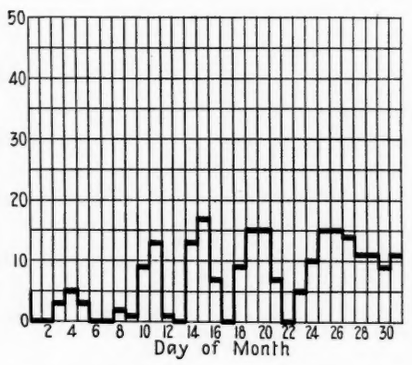
For radiation installed for any other outside temperatures than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).

	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree-Days	127	48	87	0	3	192	79	195
Lbs. of Coal per Sq. Ft. of Radiation for May, 1930	1.02	0.38	0.70	0	0	1.54	0.63	1.56
Gals. of Oil per Sq. Ft. of Radiation for May, 1930	0.087	0.033	0.060	0	0	0.132	0.054	0.134
Cu. Ft. of Gas per Sq. Ft. of Radiation for May, 1930	12.2	4.6	8.4	0	0	18.5	7.6	18.7

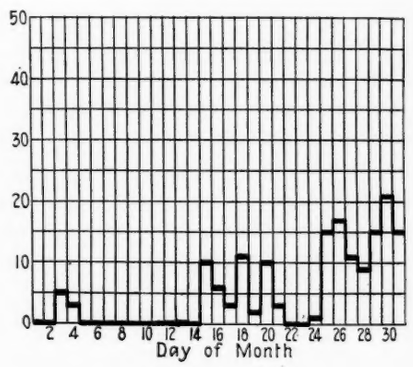
(See Footnote)



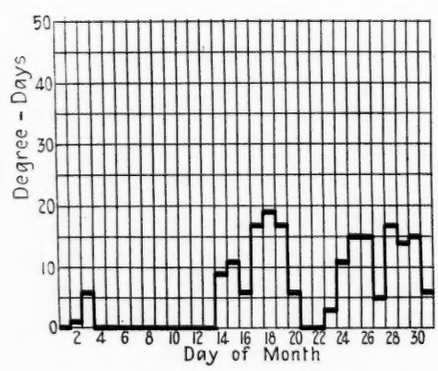
New York, May, 1930
Degree-Days 156—to Date, 5065
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.25
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.107
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 15.0
(See Footnote)



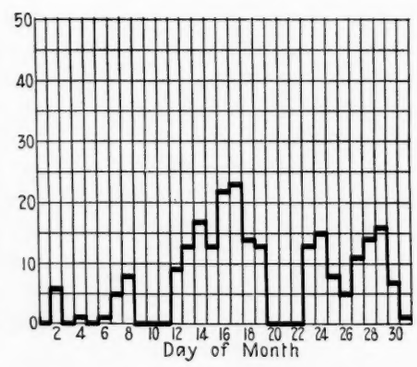
Boston, May, 1930
Degree-Days 222—to Date, 5562
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.78
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.152
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 21.3
(See Footnote)



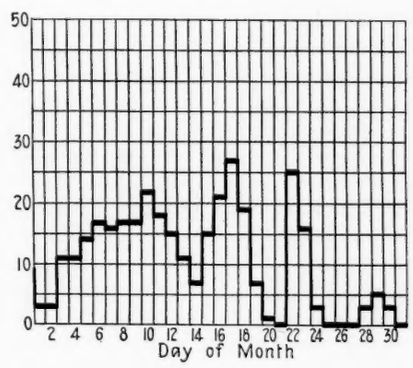
Pittsburgh, May, 1930
Degree-Days 157—to Date, 5334
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.26
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.108
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 15.1
(See Footnote)



Chicago, May, 1930
Degree-Days 193—to Date, 6205
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.54
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.132
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 18.5
(See Footnote)

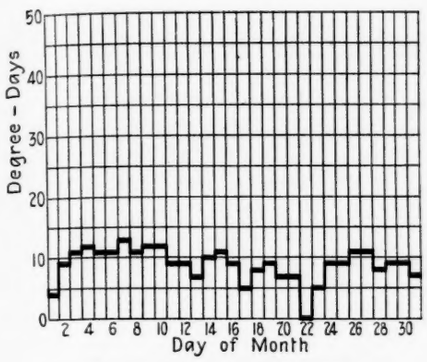


Minneapolis, May, 1930
Degree-Days 236—to Date, 7846
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.89
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.162
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 22.7
(See Footnote)

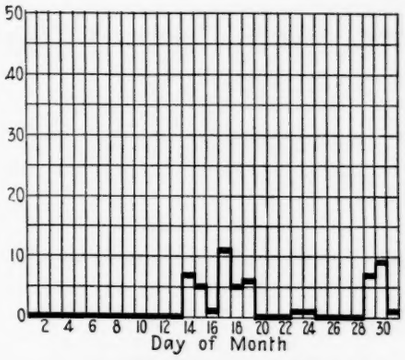


Denver, May, 1930
Degree-Days 327—to Date, 6140
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.62
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.224
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 31.4
(See Footnote)

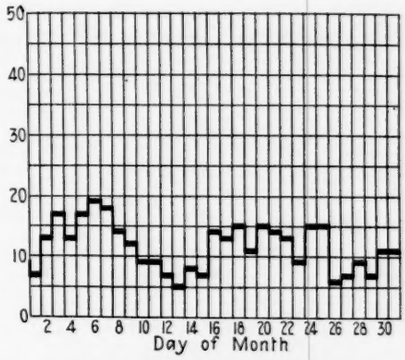
These figures must be corrected for local conditions as explained above.



San Francisco, May, 1930
Degree-Days 275—to Date, 2129
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.20
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.189
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 26.4
(See Footnote, Page 116)



St. Louis, May, 1930
Degree-Days 54—to Date, 4509
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 0.43
Gals. of Oil per Sq. Ft. of Radiation for this Month 0.037
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 5.2
(See Footnote, Page 116)



Seattle, May, 1930
Degree-Days 360—to Date, 4577
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.88
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.247
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 34.6
(See Footnote, Page 116)

Death of William Henry Bristol

Prof. William Henry Bristol, inventor of the Bristol phone and numerous recording instruments, and president of the Bristol Co., Waterbury, Conn., died in his seventieth year at the New Haven Hospital, June 18. Professor Bristol had been ill for several months from a blood clot in the region of the heart. In 1899, Professor Bristol founded the Bristol Company to manufacture and market his inventions.

He matriculated at Stevens Institute of Technology at Hoboken in 1880, and was graduated in 1884 with the degree of M.E. During the many years which he devoted to his scientific work, Professor Bristol developed a complete line of recording instruments adapted to meet almost every industrial requirement. His inventions included instruments for measuring pressure, temperature, e'ectricity, speed and time.

In 1916, he conceived the idea of recording sound and action simultaneously. The invention and production of the Bristol phone followed. To perfect this instrument he spent nearly $1,000,000 in the construction of a fully equipped motion picture laboratory and studio in Waterbury.

He was a member of many societies including the A.S.M.E., the Society of Electro-Chemical Engineers, the Society of Motion Picture Engineers, and the American Institute of Electrical Engineers. He also was a fellow of the American Association for the Advancement of Science.

Louis Raisler

Louis Raisler, treasurer of the Raisler Heating Company and the Raisler Sprinkler Co., Inc., 129 Amsterdam Ave., New York, died suddenly of cardiac trouble at his residence, Monday, June 2. Mr. Raisler was 48 years of age and well known as one of the leaders of the construction industry in the metropolitan area.

E. D. Green

E. D. Green, president of the Garden City Fan Co., Chicago, Ill., and the Gibson Oat Crusher Company, a subsidiary, died at his quarters in the South Shore Country Club, May 29. Mr. Green was born in Bergen, N. Y., in 1865, and was the son of W. W. Green, founder of the Garden City Fan Company, who died thirteen years ago.

W. A. Russell

W. A. Russell, of W. A. Russell & Co., Grand Central Terminal Bldg., New York, died at St. Johns Hospital, Yonkers, N. Y., June 20. Mr. Russell was in his 68th year at the time of his death, which came unexpectedly after a short illness. He was one of the pioneers in the air valve industry and founded the company in 1890.

National Pipe and Supplies Association and Plumbing and Heating Industries Bureau to Cooperate

With the object of correlating and unifying the merchandising efforts of the distributing and retailing branches of the industries, the executive committee of the National Pipe and Supplies Association announces the adoption of a merchandising and educational program to be carried out jointly in 1930 and 1931 by the National Pipe and Supplies Association and the Plumbing and Heating Industries Bureau.

The action of the executive committee was taken at Pinehurst, N. C., on May 14, during the annual convention of the National Pipe and Supplies Association.

Merchandising, the need for a better understanding of the function of the distributor, and the need for a closer cooperation between the wholesaler and the contractor were the keynotes of the convention.

As a result, the Educational and Merchandising Program was drawn up and defined in a resolution which provides for three definite steps:

1. Determination of the exact economic position of the wholesaler and the dissemination of the facts as disclosed by this investigation.

2. Closer cooperation between the wholesaler as represented by his salesman and the plumbing contractor. The resolution as adopted says in part: "It is recommended that a business service be developed gradually in conjunction with the Plumbing and Heating Industries Bureau whereby help could be given to plumbing and heating dealers in order to improve their credit.

3. Cooperation with manufacturers with the object of bringing about greater simplification and the development of "different distribution policies that will be satisfactory to the members of this association and to the plumbing and heating industry in general."

To carry out this educational program, the association has retained Theodore N. Beckman of the marketing division of the College of Commerce of Ohio State University. Mr. Beckman, who is the author of "Wholesaling," the only book on this subject, is the counsellor of the Automotive Distributors of the United States and counsel for the Census Bureau of the United States Department of Commerce.

One of the most important features of the Educational Program of the two organizations is the assistance which it is proposed to give to salesmen employed by wholesalers who regularly call on all of the 35,000 plumbing and heating contractors.

Winters Not Becoming Mild, According to Weather Bureau

There are "good psychological reasons for the belief that the weather is changing"—that winters are colder than they formerly were, or summers hotter—but, as a matter of fact, the weather is not changing and has not changed perceptibly in historic times, according to the Weather Bureau, Department of Agriculture.

There are, however, temporary changes in the weather, and just as we often have a succession of warm days and then cool days, so we often experience a series of warm years followed by a series of cool years, the Chief of the Bureau, Dr. Charles F. Marvin, stated.

Efforts have been made repeatedly to discover some orderly sequence in the groups of cool and warm years, as a basis for predictions of temperature conditions, according to Doctor Marvin and other officials of the Bureau, but they have failed.

It is the consensus of weather specialists, Doctor Marvin said, that, while there is a "trace" of accuracy in some of the sequences suggested, there is no basis for saying that a warm or rainy period may be expected every 35 years, or every 8 years, or once in any other fixed number of years.

Since 1920, there has been an unbroken series of warm winters in the Washington, D. C., area, and it is on such unusual conditions that the common belief in changing climatic conditions is based, according to the Bureau. Unquestionably there will be cooler winters following the present warm conditions.

"Children who have been growing up in the last decade," Doctor Marvin said, "will say, when colder winters arrive, that the climate is becoming colder, because they never had such cold winters when they were young. And children who grow up in the period of colder winters will say, when some warmer winters happen along, that the climate is getting warmer, and they will hark back to the cold winters of their youth."

As a matter of fact, the Bureau's charts, covering in some cases more than a century, show that the averages for five-year periods have changed little. Rainfall and temperature have maintained a high degree of stability.

Temperatures have been particularly constant. The departure from normal, averaged for a three-year period, has seldom been more than 3° F., Bureau charts show.

So-called cycles of cool-rainy and warm-dry years have never been sufficiently effective to result in improving or damaging crops, according to J. B. Kincer, chief of the division of agricultural meteorology of the Weather Bureau.

Tracing of a Cycle Proves Unreliable

An eight-year "cycle" of this kind, traced for several decades at Marietta, O., where for a long time there was a period of wet, cool weather each eight years, has proved in the last 20 years to be entirely unreliable, he said. The rainy weather did not appear according to schedule, nor did the dry weather.

Climatic conditions have been so nearly constant, when considered over 20-year periods, Mr. Kincer said, that the percentage of annual rainfall at any point which falls in spring, summer, fall, or winter, in each such period, has been almost unchanged for as long as the records have been kept. He exhibited a chart depicting precipitation of the three kinds which appear in the United States.

The Weather Bureau, generally considered as an agency for making day-to-day forecasts, actually thinks in terms of centuries rather than days. Asked if there are weather cycles, Doctor Marvin said that the records are insufficient to show conclusively whether there are or not, since the longest period covered is "only a little more than 100 years."

"We must have records covering at least 200 years before we can answer finally," he said, "and we should have them for 500 years to make a satisfactory study."

The records of weather conditions which can be considered to be complete cover only 50 to 60 years, Doctor Marvin said, and much more information is needed to determine whether or not the longer cycles suggested have any basis, in fact, sufficient to make them a proper basis for forecasting weather.

Temperatures 442 Degrees Above Normal to June First

Temperatures in 1930, up to June 1, showed a total of 442° above normal, according to an oral statement made June 6 on behalf of the Weather Bureau, Department of Agriculture.

February was especially warm, it was pointed out. The temperature for the month averaged 7.3° higher than normal. This average was higher than any for at least the past eight years, and it was added that eleven of the last thirteen Februaries have been warmer than normal. February, 1929, was one of the exceptions, as it was colder by 4° than normal.

The first half of April also was warm, but it then became cooler, especially in the north central and northeastern regions, it was stated. The first week in May was warm, with a cold wave coming up in the West and gradually spreading across the country, but being followed by warm weather. May was somewhat warmer than the average and added about 120° to the accumulated excess, it was said.

The majority of the accumulated excess piled up early in the year and then cooler weather set in to retard it, but May again began adding to the total, when a number of days were warmer than normal. If there had not been a break preceding May, temperatures for the period would be still more above normal.

The high February temperatures are reflected in the degree-day figure for that month, the total degree-days for nine cities for the month being 6215 this year as compared with 8926 last year, a decrease of 30% for that month alone.

Stevens Tech to Study Smoke Problems in New York

At the commencement dinner of trustees of the Stevens Institute of Technology, June 6, at the Astor Hotel, Dr. Harvey N. Davis, president, announced the appointment of Col. Elliott H. Whitlock as research professor of mechanical engineering to deal exclusively with the problem of smoke abatement in the New York metropolitan area. A gift to the college of $40,000 has made possible this anti-smoke campaign for the first two years.

Doctor Davis, one of the organizers last year of the New York-New Jersey Smoke Abatement Board, and a member of that board, said the methods used in Cleveland by Colonel Whitlock, where he is smoke commissioner, have been regarded as the best in any American city. Colonel Whitlock will be available for consultation with municipal authorities on both sides of the Hudson.

Oil Burner Shipments for May

May shipments of oil burners, as reported by 50 manufacturers whose output constituted 60% of the total for the industry in 1927, amount to 5901 as compared with 3923 in April and 4474 a year ago. Of this total, 4398 were mechanical draft domestic burners; 1008 natural draft domestic burners, and the remainder were industrial burners.

How Anthracite Coal Service Is Promoting the Use of Hard Coal

A good example of successful cooperative work in the interest of anthracite and hard coal-burning equipment, such as domestic stokers, is given by the Anthracite Coal Service, an organization of heating and combustion engineers maintained by the Anthracite Operators Conference. Anthracite Coal Service headquarters are established at 1421 Chestnut St., Philadelphia, Pa., while division headquarters are maintained in a number of other cities. Engineers reporting to these various headquarters are permanently stationed in twenty additional cities, thus making them available to practically all communities in which anthracite is distributed.

In addition to rendering technical advice to aid anthracite consumers, anthracite Coal Service representatives have a definite, though indirect, place in the merchandising of anthracite. Anthracite Coal Service engineers work directly with the owners or managers of the larger power plants or heating plants, to cooperate with them in increasing their efficiency.

Training classes for employees of retail coal companies, conducted by Anthracite Coal Service, are taught the fundamentals of heating engineering which will permit them to analyze the heating plants of their consumers and to correct any deficiencies which may be found. It is significant in this respect that an analysis of 6,000 calls, which were made on consumers who had complained of unsatisfactory heating results with anthracite, showed that over 98% of the complaints were caused by defective heating systems or firing methods.

As a result of the training classes 2,786 employees of 1,782 retail coal companies in 111 centers throughout the anthracite-consuming territory are now equipped to guarantee heating satisfaction to their customers.

The training includes both a lecture course, based on a textbook written by Anthracite Coal Service, and practical applications of the lectures in the field. For the latter purpose the heating plants of customers are used as a laboratory. These heating plants are inspected by the Anthracite Coal Service representative and the dealer taking the training. In this way the dealer is impressed with the practical application of the lectures and the consumer given the type of service which increases the efficiency of his heating plant and thereby increases the value of anthracite to him. These inspection calls, during which minor repairs and adjustments are made and, where necessary, recommendations made for more extensive work to be done by the heating or plumbing contractor, are continued with each dealer until he is deemed to be proficient in this work.

During the past year dealers in 22 cities have cooperatively announced and stressed their service departments in newspaper advertising campaigns and, as a further stimulus to their efforts, the anthracite operators, through the Anthracite Coal Service, have contributed 50% of the cost of newspaper campaigns. In addition to their cooperative advertising, the retail coal merchants individually have given publicity to their service departments through letters to their trade and through circulars, some of which were designed by them and some of which were supplied by the anthracite operators.

Two portable exhibits, which include continuous motion picture projectors, have been designed and are being exhibited by Anthracite Coal Service at "Better Home" shows, heating and ventilating shows, and coal merchants' conventions. A permanent exhibit, located in the Architects Samples Bureau, New York, is on display, and the engineers of Anthracite Coal Service assist retail coal merchants in planning and designing anthracite exhibits and window displays throughout the anthracite-burning territory. A feature always carried out in the anthracite exhibits is that of an attempt to interest the fuel buyer in the importance of the selection of the proper size of anthracite to be used in his particular heating plant.

As a further development of their service activities, more than 500 retail coal merchants, during the past year, have purchased portable vacuum cleaning outfits with which they will remove ash deposits on the boiler and flue surfaces and from the smoke pipe. In the majority of such cases, the retail coal merchant makes a charge for vacuum cleaning in an amount which will cover the cost of that cleaning.

In some instances the heating contractor had objected to vacuum cleaning at cost, but he soon found that where the retail coal merchant was rendering vacuum cleaning he discovered many cases where repairs by a heating contractor were needed. Consequently, the repair business secured was much greater than any small loss of revenue which might have resulted from what he had at first considered a competitive effort by the retail coal merchant to secure cleaning business.

A spirit of cooperation between the retail coal merchant and the heating contractor thus was fostered and where such cooperation exists the practice was eliminated of the retail coal merchant placing responsibilty for failure of the heating plant on the heating contractor, and vice versa. Such a practice had never been helpful to the customer, or to either the coal merchant or the heating contractor.

Meeting of Heating Board of Trade in New York City

At the Building Trades Employers' Club in New York, the Heating Board of Trade held a meeting, May 7, and discussed preliminary plans of operation and passed upon several committee reports that were presented.

President Werner Nygren, discussed some of the more serious practices that obtain and which are detrimental to the industry. D. H. Sawyer, the newly appointed secretary was presented at this meeting.

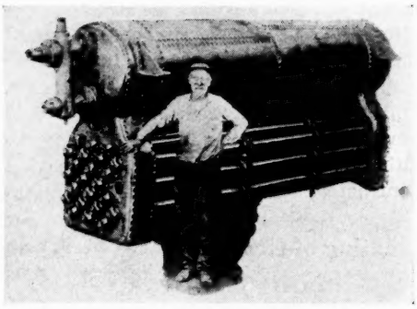
Addressing the meeting, which numbered more than a hundred, he said he wanted the members to make use of the new office at 50 Union Square East, and to make it a clearing house for any difficulties which may arise.

The treasurer of the board, P. R. Mork of Crane Co., made his report which was accepted. S. C. Carrier of Heggie-Simplex Boiler Co. reported as chairman of the membership committee. R. A. Wolff, who headed a subcommittee in connection with dues, presented a report which had the approval of the board of governors. This report, which received the concurrence of the meeting, set the dues at $50 for engineers, contractors, sub-contractors, jobbers and manufacturers of small specialties, and $100 for manufacturers. A recommendation embodied in the report, setting $10,000 as the probable amount needed for operating expense during the first year to be raised through subscriptions by members, was sanctioned and 50% of the amount was pledged by a number of those present.

Secretary Sawyer will write a letter to every member asking that suggestions be made for the activity of a planning and scope committee which is to be created.

Allan Hoover Working for American Radiator Company

Allan Hoover, youngest son of the President, reported for work June 23 at the Bayonne plant of the American Radiator Company. He will work in the production department during his vacation from Harvard Business School. Mr. Hoover is the only student at the Bayonne plant, although each summer the company takes student workers for office positions. The amount of his salary has not been disclosed.



First Heine Water Tube Boiler Constructed in 1882

First Heine Boiler on Exhibit

The first Heine water tube boiler, which was constructed in 1882, is on exhibition at the Ford Industrial Museum in Detroit. This boiler was sold to the First Regiment Armory Association in St. Louis and installed during 1882, continuing in service until the Armory was destroyed by fire in 1917. It was later salvaged by the Heine Boiler Company and placed on exhibit in their shop yard at St. Louis.

This boiler, if operated continuously for the entire 48 years since it was built, 24 hours a day, 365 days a year, would have produced approximately the same amount of steam, in nearly a half-century, as the steam generating units used by the New York Edison Company in the East River Station produce at maximum rating in less than 11 days.

When constructed the first Heine boiler represented the best practices in boiler building at that time. As compared to present-day standards, with regard to workmanship and material, it illustrates how primitive those standards were and how tremendous has been the advance in pressures and steam output.

Crane Company Celebrates Seventy-fifth Anniversary

What might be termed an international picnic and celebration will take place July 3, when employees and officials of the Crane Company, together with their families and friends, will gather in all parts of the world to commemorate the beginning of a business, founded by R. T. Crane 75 years ago. The event will be celebrated in Paris, London, India, Brazil, Mexico, and Cuba and in hundreds of cities of the United States and Canada. All Crane offices, branches, exhibit rooms, and warehouses throughout the world will be closed on that day.

Numerous improvements introduced by Mr. Crane and his company in the field of plumbing and piping have helped to make possible modern skyscrapers with their perfect water supply, drainage, and sanitation. They have built 75-in. valves for water mains; valves and fittings to control pressures up to 3000 lbs. to the square inch, and piping materials to bring about industrial and domestic improvements, economies, and labor savings.

Though plumbing improvements are perhaps the best-known contribution of this company to modern life, an even greater one lies in the development of valves and fittings to hold enormous pressures and superheat. These valves and fittings, and the research that R. T. Crane started in metallurgy and piping metals, have affected virtually every industrial process of the present day.

Mining Companies Show Increased Interest in Ventilation

According to Daniel Harrington, chief engineer, Safety Division, Bureau of Mines, the metal mining interests have never been more inclined toward systematic ventilation of their properties than now.

This is manifested in numerous activities, not only of individual companies but also of organizations concerned with the improvement of conditions affecting ventilation of metal mines.

Numerous inquiries and discussions concerning various details entering into the ventilation of metal mines have been made. Some of these are:

What is the correct type of main fan or of auxiliary fan?

What is a good type of ventilation door, fire door or ventilation regulator?

What is the most effective lining of a main air-carrying shaft?

Should the fan be so placed as to allow ready reversing of air direction?

These and a large number of additional questions have been discussed, although a definite answer has not always been forthcoming.

For instance, there is a wide difference of opinion as to the construction of a satisfactory type of fire door—one which will resist fire, will not warp or sag, will close tightly and leak little, will not decay or rust or otherwise disintegrate, and can be used from day to day if necessary.

There is absolutely no question that well-placed doors may be utilized to advantage in saving employes in both coal and metal mines at time of fires and probably to a lesser extent in explosions.

Metal mines are adopting mechanical ventilation much more extensively than in the past. This movement has naturally been accompanied by an increased use of such so-called coal mine devices or adjuncts as overcasts, undercasts, regulators, splits, doors, brattices, and even curtains for air deflection.

Thoughtful and far-seeing metal mine operators are now providing and maintaining air courses not only for intake but also return or used air, even sinking shafts, driving raises, drifts, etc., wholly for ventilation. Sealing of abandoned workings is being done in some mines to conserve air supply or to prevent air vitiation.

Although many mines hold main haulage shafts on return air, there are numerous instances where the far safer system of holding main haulage on intake or at least fresh air is maintained. In general, present day fan installations at metal mines allow reversing the direction of air currents, but unfortunately only a small percentage of the mines install doors in such manner as to be able to take advantage of this reversing feature if it is needed.

Some of the wide-awake metal mine operators are using smooth lined, fireproofed, main air carrying shafts, thus reducing fan power consumption and at the same time providing the most effective type of fire insurance. Other mines are manipulating the air currents—where they are thoroughly under control; this means use of fan, doors, overcasts, etc.—to prevent fungus growth, or even to kill fungus where it gets a start.

"Economical Distribution of Steam in District Heating"

The purpose of the pamphlet, "The Economical Distribution of Steam in District Heating," is to develop the relationships of the variables determining the relative costs of transmitting steam at various pressures.

The author arrives at the conclusion that the transmitting of steam at high pressures, when the pressure drop per hundred feet is the same as for the low pressure line, is more costly than the use of low pressures. If, however, the greater pressure is used up in overcoming friction in a smaller line there is a considerable saving when the load factor is 100%. The saving is still greater when the load factor is less than 100%.

A. C. Abell is the author. Published by the Engineering Experiment Station of the State College of Washington, Pullman, Wash. Size, 6 in. x 9¼ in. Pp. 22.

Anthracite Club Re-elects Officers

The Anthracite Club of New York at its May meeting re-elected its officers as follows: President, O. F. Ostby; vice-president, A. F. Duemler; second vice-president, Dwight H. Falkner; treasurer, L. N. Burnside, and secretary, Noel Cunningham.

New Apparatus and Appliances

Inventor of Self-Tapping Screws Receives Franklin Institute Award

Heyman Rosenberg, vice-president of the Parker-Kalon Corp., New York, was among the distinguished scientists and engineers to be honored by the Franklin Institute of Philadelphia, at the medal meeting held by the Institute, May 21.

Mr. Rosenberg was awarded the Institute's Certificate of Merit for his development of Parker-Kalon hardened self-tapping screws. His first achievement along these lines took the form of a self-tapping sheet metal screw that overcame the difficulties previously encountered in joining and making fastenings to light gauges of sheet metal. This screw, so threaded and hardened as to make it capable of cutting a thread in sheet metal, as a tap does in iron or steel, as it is screwed in, was such an outstanding improvement in fastening devices that its extensive adoption by the metal-working industries followed.

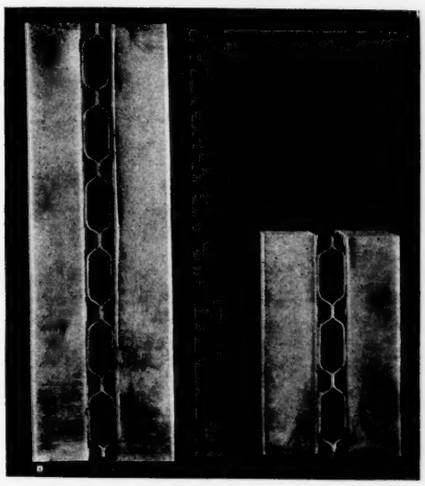
Having produced an easy, quick and cheap means of making light gauge sheet metal assemblies, the inventor's thoughts turned to the problem of making fastenings to solid sections of material, such as iron, brass and aluminum castings, steel, bakelite, etc.; where the tapping of holes, with its breakage of taps, upkeep of tapping machinery, etc., is often a factor in the cost of the article. After research and experiment, Mr. Rosenberg devised and patented the screw, now generally known as a hardened metallic drive screw. This screw has a spiral form of hardened thread, which cuts or forms a corresponding female thread in the material as it is hammered in or otherwise driven in.

As the original design of sheet metal screw was suitable only for use in light gauges of metal and as the hardened metallic drive screw could be used only where a permanent fastening was desired, due to the fact that once driven in this screw could not readily be removed, there still existed a need for a similar device which could be used in heavy gauges of sheet steel; and also one suitable for making fastenings to solid sections of material and which could be removed and reinserted when necessary. Mr. Rosenberg's inventive genius then created an improved form of his original self-tapping sheet metal screw, which has met these requirements.

His latest achievement in fastening devices is the screwnail, combining the driving qualities of a nail and the holding qualities of a screw. This device was designed to give a more secure means of fastening sheet metal to wood and has been accepted in trades where sheet metal to wood fastenings have to be made.

Robras Box-Fin Concealed Radiator

An improved box-fin type Robras concealed radiator has been announced by the Rome Brass Radiator Corp., 1 East 42nd St., New York.



Sections of Robras 3- and 5-Tube Box-Fin Radiators

Among the improvements in the new radiator are greater heat conductivity, more rugged construction, smaller space occupied, light weight, an increase of 300% in the area of water or steam passages, and box fins with two and a half times greater contact than their present radiator.

The manufacturer claims that the new radiator requires less fittings and connections, is simpler to install and at the same time retains the original flexibility of the older unit.

Jas. P. Marsh & Company Radiator Valve

Modern Design in Radiator Valves

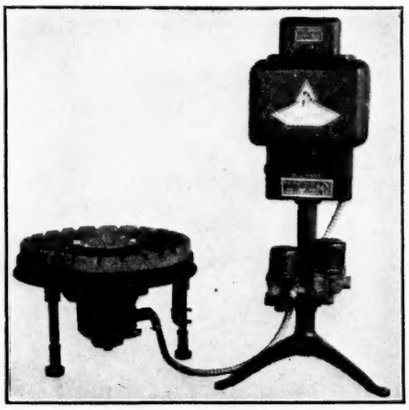
A radiator valve of artistic exterior design has been perfected by Jas. P. Marsh & Co., Chicago, Ill. The valve lends itself to modern radiator designs and interior finishes in buildings of all types.

The valve body is made of cast brass. The proportions of the body permit a full flow of steam through the valve when wide open. The absence of a raised edge at the valve seat makes it rapid draining and dirt free. Bodies are regularly furnished in angle, straightway, offset and right- and left-hand corner types in all sizes from ½ in. to 2 in.

Incorporated in the valve is a packless feature, the stem seal being formed by four discs which are clamped in between the valve body and bonnet with their center bearing on the upper and lower faces of a collar machined integral with the valve stem. The inner discs which bear against the stem collar are of Monel metal and the outer reinforcing discs are of corrosive-proof spring steel. These discs form a double seal and either set will insure a steam or vacuum tight joint around the stem. It is impossible for vibration to open or close the valve or change its adjustment as the stem seal will hold it securely.

Made of Monel metal, the valve disc is of conical shape and is provided with a swivel connection at the point where it is attached to the interior thread nut. This affords a modulating feature that permits the heat output of the radiator to be controlled by the operator.

Robras Box-Fin Radiator 32 In. x 10¾ In. x 5½ In., with Capacity of 56¼ Sq. Ft.



Silent Automatic Model E Burner

Silent Automatic Model E Burner

Model E oil burner for smaller homes has just been brought out by Silent Automatic Corp., Detroit, Mich. It is built for round and rectangular boilers and furnaces.

For round boilers and furnaces the minimum diameter at the grate line is 11½ in.; the maximum is 19 in. When used in rectangular boilers and furnaces, the width limits at the grate line range from 11½ to 19 in., with a maximum grate area of 3 sq. ft. The greatest ratio of grate length to width is two to one. Maximum load limits for steam is 350 sq. ft. and 560 sq. ft. for water. Maximum oil flow is 1½ gal. per hr.

Wilcostat Room Temperature Control

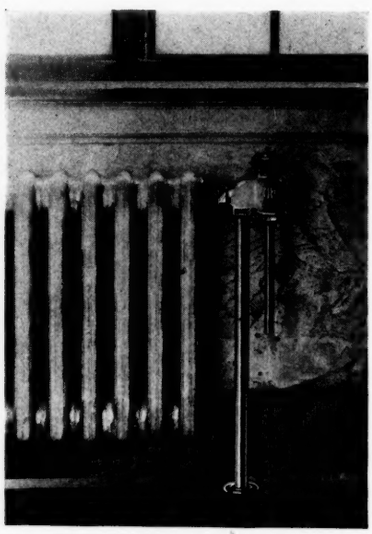
An automatic room temperature control for gas-fired circulators, called the Wilcostat, has been developed and is being supplied to manufacturers and distributors of circulators by The Wilcolator Company, Newark, N. J. This device maintains room temperature within 1° of the temperature desired, and can be installed on all standard makes of circulators at the factory or while actually in service. It operates by increasing or decreasing the flow of gas as the room temperature changes.

The unit is rugged, small, compact, and attractively finished to blend with the circulators to which it will be attached. Service adjustments are reduced to a minimum, and are simple to make.

Wilcostat Temperature Control for Gas-Fired Circulators

Minneapolis-Honeywell Modustat

Adjustable between the ranges of 60° and 80°, the Modustat, an automatic self-contained temperature control for individual radiators, has been announced by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. This device will modulate from a fully open to a completely closed position on a change of 5° in room temperature. Only as much of the radiator is filled with steam as is required to counteract heat losses and infiltration of cold air.



Modustat Temperature Control for Radiators

The sensitive thermostatic medium is located in the bottom of the tube which is extended from the base of the valve casing itself. A plug, in which a fine hole is drilled, divides the tube into two chambers. The volatile liquid is retained in that portion of the tube which is below the plug, only the vapor produced by gasifying the liquid being able to pass through the drilled hole in the plug.

The plug virtually isolates the lower chamber in the tube from the upper, and by so reducing circulation to the valve body itself, effectively decreases heat conduction, which insures the accurate operation of the device in response to room temperature. All of the actuating mechanism of the device is solidly covered so it cannot be tampered with or destroyed.

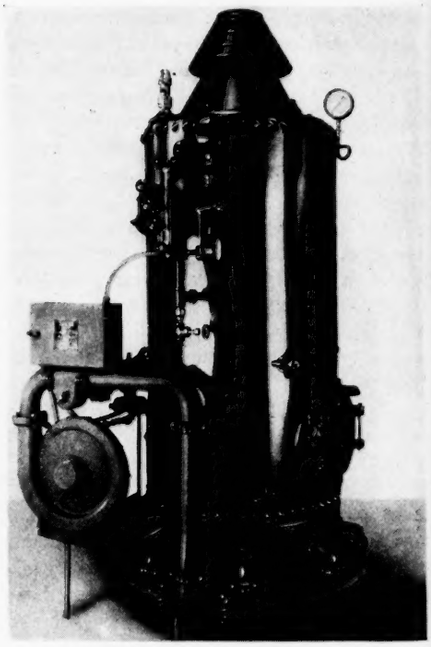
Modustats are for use in two-pipe systems only. The valve is of the packless type, and the whole can be as easily installed as an ordinary hand valve.

Small Gas-Fired High-Pressure Boilers

A series of small gas-fired high-pressure boilers to supplement their line of type V SteCom generators has been announced by Steam and Combustion Co., Chicago. Four additional sizes are provided by this step, 10, 13, 17½ and 23 horsepower, making a total of ten type V boiler sizes, with a capacity range from 134 to 10 horsepower.

These sizes have been developed to provide in smaller capacity units the same high efficiency and dependability as are offered in the larger SteCom boilers. These boilers will have essentially the same features as the larger boilers, including a forced-draft combustion system. Low-pressure combustion air and special safety pilot light are used, however, in contrast with high pressure air and pressure pilot in the higher capacity ranges.

SteCom type V boilers are complete steam generating plants, consisting of a vertical firetube boiler shell, furnace and burner system, and controls. The boiler shell and burner system are designed as a unit and are so inter-related as to secure perfectly balanced performance and utilization of "all the heat there is in the gas."



SteCom Gas-Fired Boiler

400 POWERS THERMOSTATS
and 550 Radiator Valves installed here

THE SHARP BUILDING, LINCOLN, NEBR.

Architect
J. G. MCARTHUR, OMAHA NEBR.

ONE important feature which differentiates the Powers system of temperature control from all others is its performance, on the job as well as in a sales demonstration, in giving

True Graduated Control of Valves or Dampers

so that—valves controlling radiators or coils are not wide open at one time and tightly closed at another but take and *hold* the intermediate position that feeds the steam or hot water in exact proportion to the heat requirements; and, dampers mixing hot and cold air, take and *maintain* the intermediate position that delivers properly warmed air to the rooms without alternating drafts of hot and cold air so objectionable in many indirect and forced air heating systems.

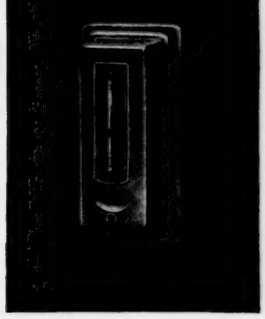
When positive, snap action control is desirable, we supply it, of course.

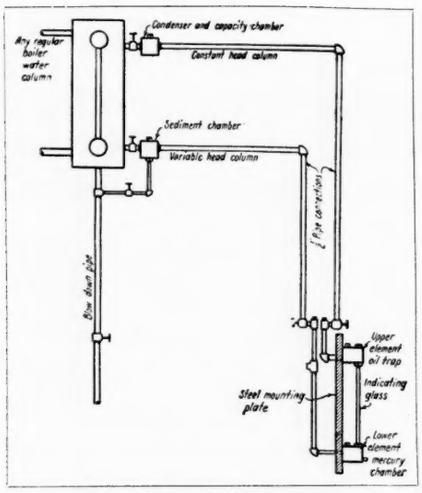
THE POWERS REGULATOR CO.
35 Years of Specialization in Temperature Control

Chicago: 2728 Greenview Avenue · *Offices in 35 Other Cities* · New York: 137 East 46th Street
The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

POWERS

THERMOSTATS *are Better Because* they often give 15 to 20 years of Accurate Control without repairs of any kind.





McNeill Liquid Level Gauge

Remote Water Level Gauge

A water level gauge which can be located anywhere regardless of the position of the regular water column, is being marketed by the Boiler Room Improvement Co., 4057 West Van Buren St., Chicago, Ill. It is visible at a wide angle range, many times that of the usual water column, regardless of height. Visibility is increased by the use of an indicating fluid which will not mix with the condensation.

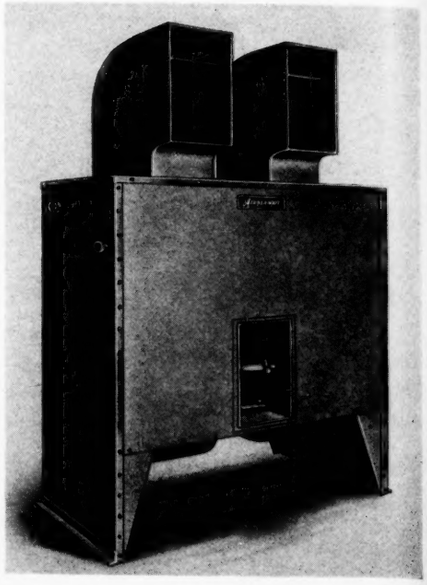
The device, known as the McNeill Liquid Level gauge, is a U-tube in which the movement of the mercury is at all times the direct result of the head pressure of the water or liquid being measured. It consists of an upper and lower actuating element mounted upon a steel plate. The outer chamber of each element is connected to the other element with an ordinary gauge glass made of special glass with suitable glands and stuffing boxes. The inner chamber is connected through the back of the steel mounted plate with ½-in. pipe to the water column, the contents of which it is desired to measure.

The gauges are manufactured in three standard sizes giving 13, 14 and 16-in. range of indication.

Skinner Brothers Airblanket Heating System

Skinner Brothers Mfg. Co., Inc., St. Louis, Mo., announces the Airblanket method of heating for large open space buildings. It employs specially-designed unit heaters, which have been patented by the manufacturer.

The Airblanket method of heating is an industrial heating process in which a blanket, or ceiling, of low temperature fast moving air is projected horizontally over the breathing zone of a building for the purpose of holding the warm air issuing from a unit heater in that zone.



Floor Type Airblanket Unit Heater

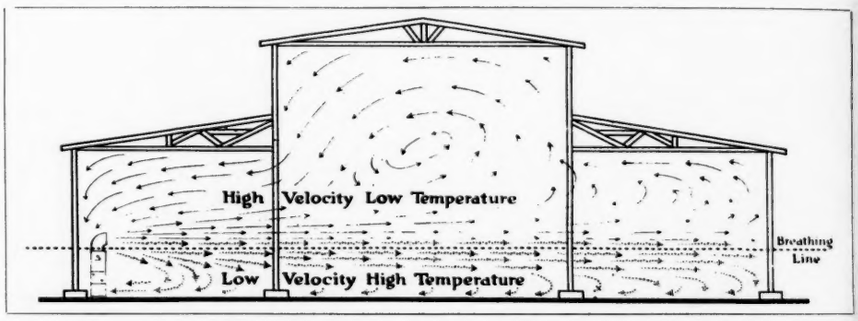
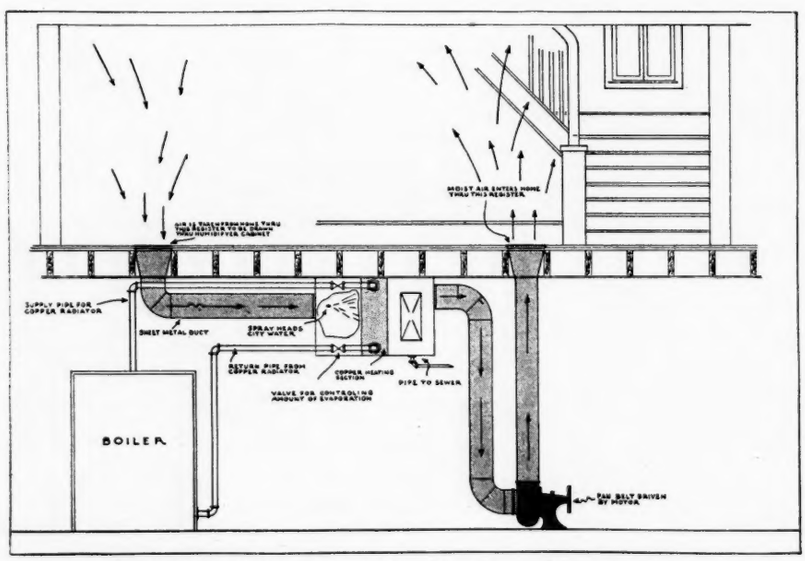


Diagram Showing Airblanket Principle with Flow-Type Unit Heater

The manufacturer asserts that the use of the new method will make possible large savings in the cost of heating industrial buildings, particularly those of the saw-tooth and monitor types. The basis for this assertion is that the necessity for first filling the space above the breathing zone with warmth, before the breathing zone itself can be properly warmed, is entirely done away with.



Doherty-Brehm Humidifier for Large Residences

Doherty-Brehm Humidifying System

A humidifying system for large homes is being marketed by Doherty-Brehm Co., Minneapolis, Minn. Air is drawn from the rooms through a grille and 10-in. sheet metal duct into the washing chamber. Here the air is sprayed and saturated with moisture, before passing through the copper heating section. The air is then drawn downward by the motor fan and then forced upward under pressure through the grille outlet into the room.

The temperature of the heating section is controlled by a valve located on the supply pipes connecting the heating section with the boiler.

Known as the Model B basement installation the unit is designed for residences exceeding 20,000 cu. ft. in contents. The volume of air circulated in the house ranges from 30,000 to 60,000 cu. ft. per hr. The motor is of the repulsion induction type. The air washer and humidifying cabinet is 46 in. long, 60 in. high and 30 in. wide.

Irving Trust Company Building
One Wall Street

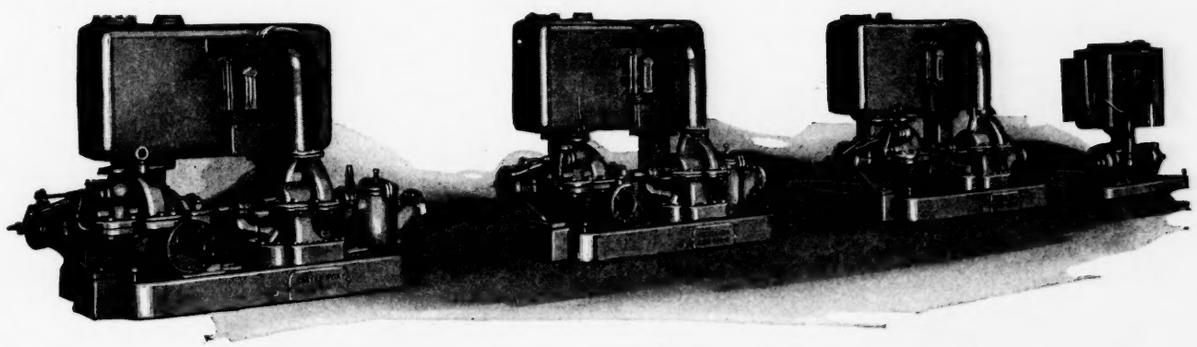
ONE OF THE

WORLD'S TALLEST BUILDINGS

Located on the most valuable ground in the world justified the highest talented engineering and equipment.

Therefore, Ames was selected.

Architects — Voorhees, Gmelin & Walker
Engineers — Meyer, Strong & Jones
Contractors — Baker, Smith & Company
Builders — Marc Eidlitz & Son, Inc.



AMES PUMP COMPANY, Inc.
30 CHURCH STREET NEW YORK CITY
Affiliated with
AMERICAN LOCOMOTIVE COMPANY

Cooling Unit for Stores and Offices

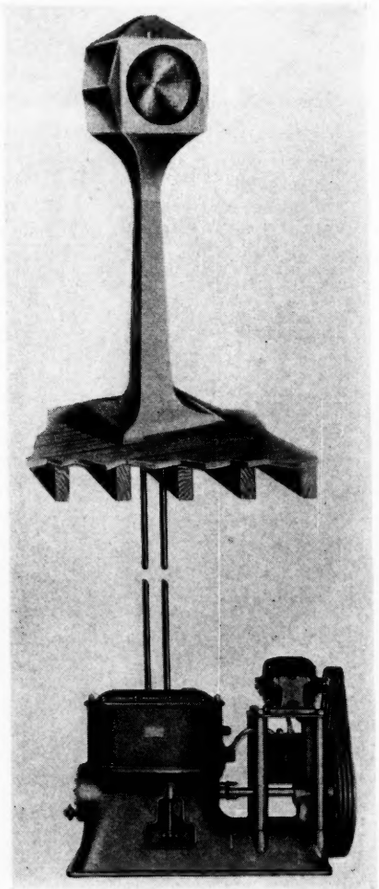
Designed for stores, candy and drug stores, barber and beauty shops and the like, a cooling fan has been placed on the market by the Peerless Ice Machine Co., 515 West 35th St., Chicago, Ill.

The Peerless cooling fan conditions the air directly in the space to be cooled, each fan being furnished with a cooling unit, over which the air is forced by means of fans, and the temperature of the air reduced. In passing over the cooling surface, moisture is taken out of the air, with the result that the humidity of the room conditioned is materially reduced.

The cooling unit in each fan, to which is connected a refrigerating machine, operates in flooded condition and is of welded steel construction. It is so arranged that the air is forced in close contact with the cold surfaces, and particular emphasis has been stressed in its construction toward the end to removing moisture from the treated air.

Each fan has sufficient capacity properly to load a 1-ton refrigerating machine. The refrigerating machine is not provided as an integral part of the cooling fan, but is located in some other portion of the building and connected by means of the required piping to the fan.

Base dimensions of the fan are 21 in. x 26 in., and the total height of the complete unit is 93 in. Each fan is equipped with two 1/6 H.P. motor-driven fans.

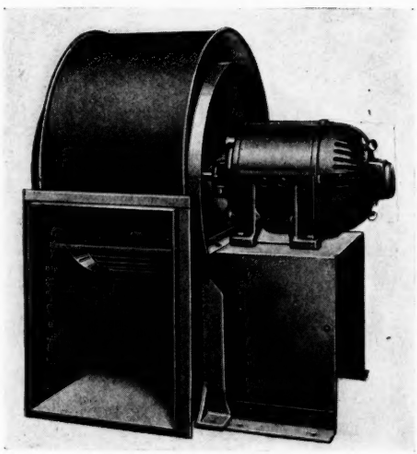


Peerless Cooling Fan and Refrigerating Machine

Autovent Universal Discharge Blowers

A line of universal discharge blowers, a new series of the Uniblade Type "D" Fan, is announced by Autovent Fan and Blower Co., 1805 No. Kostner Ave., Chicago, Ill.

By removing the bolts attaching the support brackets to the housing, the direction of discharge can be changed to any horizontal or vertical angle. Additional intermediate angles can be obtained by redrilling the housing bolt holes to conform to the support bracket drillings.



Type D Universal Discharge Blower

The design of the Uniblade wheels affords a large air inlet passage, free of obstruction, contributing to high efficiency and noiseless operation. The hub is of special construction with offsets cast in the hub to add rigidity to the wheel. The blades are die-formed and welded or riveted to the outer retaining rings. Capacities of the five sizes range from 665 to 5750 C.F.M.

International Radiator Corp. Begins Production

The factory of the International Radiator Corp., Port Chester, N. Y., is equipped with machinery for the manufacture of concealed finned radiators, enclosures and cabinets. The flattened tubes of these radiators are made of seamless copper, and end fittings with integral legs of malleable iron, galvanized inside and out. The joints between tubes and fittings are welded.

Steel recess enclosures are adjustable to exactly fill the space between the lower edge of the windowsill apron and the floor, and have removable panels.

International Extended Surface Radiator

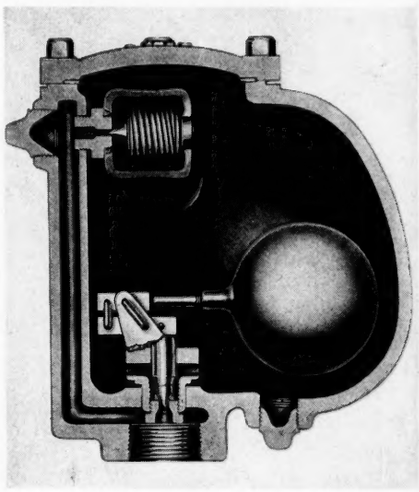
The 5-in. radiators have a greater internal volume than a 2½ in. pipe with an extra fin in every inch of length.

Sarco Combination Float and Thermostatic Steam Trap

Type FT-3 Sarco trap, a companion to types FT-1 and FT-2, is announced by Sarco Co., Inc., 183 Madison Ave., New York. This trap was developed to provide a compact draining unit for large unit heaters, steam coils and other appliances under high-pressure.

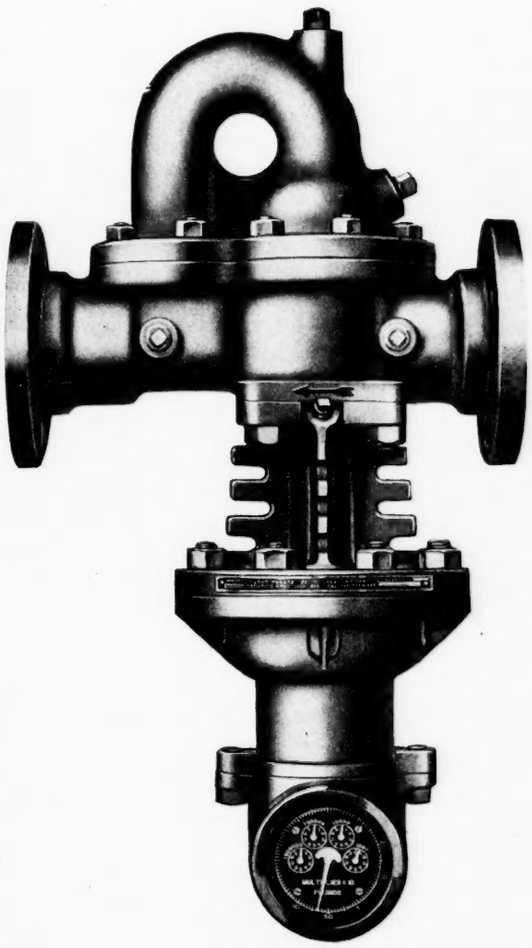
Of cast-iron the body is compact and light enough to be supported directly on the piping. A heavy, seamless copper float opens the discharge valve through a simple toggle mechanism, as condensate accumulates in the trap. The valve head and the renewable seat are of stainless steel to withstand the scoring action of scale and sediment, and to prevent wire drawing.

A thermostatic air vent is built right into the trap near the top. This consists of a small valve actuated by a helically coiled bellows, partly filled with a volatile liquid. The valve is held open as long as there is air in the trap, but closed tightly when steam reaches it and causes the bellows to expand.



Type FT-3 Sarco Trap

POUNDS OF STEAM OR "GUESSES" OF STEAM?



Shunt Meter Type KS
for Steam, Air or Gas

GUESSING is out of date! Modern methods are based on knowledge. In keeping with this modern trend Heating and Ventilating engineers are specifying the installation of Shunt Meters on steam distribution lines.

Shunt Meters are self-contained, and self-driven—they register directly total amount of flow through the steam line—they are bolted right in the line, making for convenience and economy in installation—and most important of all, they are priced low enough to be used on even the smallest of distribution lines.

Engineers who have specified their use have had exceptionally pleasing comments from owners.

The description, capacities and dimensions of the Shunt Meter, shown in our Bulletin No. 234, will be of great assistance to you.

Send for your copy—and a price list!

BUILDERS IRON FOUNDRY

"BUILDERS OF THE VENTURI SINCE 1891"

23 CODDING STREET PROVIDENCE, R. I.

Trade and Miscellaneous Notes

Coming Events

October 13-17, 1930. Twelfth annual convention and exhibition of the American Gas Association at Atlantic City, N. J. Headquarters at the Atlantic City Auditorium.

October 27-30, 1930. Fifty-ninth annual meeting of the American Public Health Association at Fort Worth, Tex. Headquarters at the Texas Hotel.

February 10-14, 1931. Fifth Midwestern Engineering and Power Exposition at Chicago, Ill. Headquarters at the Coliseum.

Presdee Appointed Member of Committee on Cooperation

Cliff W. Presdee, advertising manager of HEATING AND VENTILATING, has been appointed by the American Oil Burner Association, Inc., as a member of the Committee on Cooperation with the Heating Industry. J. F. Griswold of Hardinge Brothers, Inc., Chicago, is chairman of the committee.

Sherman Joins Battelle Memorial Institute Staff

Battelle Memorial Institute, Columbus, O., announces the addition to its staff of Ralph A. Sherman, director of research on combustion. Mr. Sherman has been fuel engineer at the Pittsburgh Experiment Station of the United States Bureau of Mines for the past ten years. He is the author of numerous reports on combustion problems and for several years has had charge of the field investigations of refractories in boiler furnaces.

National Supply Acquires Spang-Chalfant

Directors of the National Supply Company have confirmed reports that a controlling interest in the common stock of Spang, Chalfant & Company will be purchased. No change is contemplated in the personnel of Spang, Chalfant & Company, which will be operated as an individual unit.

The National Supply Company in a statement in regard to the offer says: "Spang, Chalfant & Co., Inc., are large manufacturers of welded and seamless pipe. Tubular goods are one of the most important items handled by the National Supply Company, which heretofore it has had to obtain from sources not under its own control. This acquisition, therefore, is constructive and advantageous to both companies involved, as it will give the National Supply Company a rounded line of their own manufacture, and will also give Spang, Chalfant & Company an outlet for its product."

Bolsinger Made President of Fowler & Wolfe

R. C. Bolsinger, it is announced, has been elected president and general manager of Fowler & Wolfe Mfg. Co., Norristown, Pa. He succeeds C. R. Fowler who died recently. Mr. Bolsinger formerly was treasurer of the company.

Miscellaneous Notes

May building operations for the 37 states east of the Rocky Mountains, as reported by the F. W. Dodge Corp., show a contract total of $457,416,000, representing a 5% decrease from the total for April and a 22% decrease from the total for May, 1929. Analysis of this record shows that 25% of all construction was for residential buildings, 16% for commercial buildings, 12% for industrial buildings and 18% of the total was for all other classes of non-residential buildings.

In the New England States contracts amounted to $36,513,900, as compared with a total of $42,011,900 for April and a total of $43,745,300 for May of last year.

In Metropolitan New York and Northern New Jersey, contracts amounted to $96,208,600 as compared with $100,926,700 for April and $99,364,200 for May of last year.

Contracts awarded in Up-State New York amounted to $24,478,300. This was a gain of 23% over the total of $19,870,400 for April of this year and an increase of 6% over the total of $23,110,400 for May of last year.

Figures in the Middle Atlantic States reached a total of $37,393,500, as compared with the total of $62,781,300 for previous month of this year and $59,419,500 for May, 1929. In the Pittsburgh territory contracts amounted to $57,009,100, representing a gain of 4% over the total for April of this year, but showing a decrease when compared with the total of $71,472,100 for May of 1929.

Contract figures in Southern Michigan amounted to $22,170,800, showing a gain over April's total of $21,443,500, but a loss when compared with the May, 1929, total of $48,074,100. The Chicago territory had a contract total amounting to $59,468,200 as compared with $64,758,800 for April and $102,912,200 for May, 1929. In the Central Northwest there was a contract total of $11,015,000 as compared with $10,857,300 for April and $15,407,600 for May, 1929.

The St. Louis territory contracts amounted to $21,882,800, representing a gain when compared with a total of $18,622,000 for April, but showing a decline when compared with the May total of last year of $26,331,600. The Kansas City territory showed a total of $18,898,700, a decrease when compared with the total of $23,993,000 for April of this year and $24,578,500 for May of last year.

Texas reports contracts amounting to $14,368,300 which is a decrease from the total of $22,774,100 for April of this year and $21,755,600 for May, 1929.

Col. W. H. Riblet, director of sales of the C. A. Dunham Company's Government Sales Division at Washington, D. C., for the past two years, has resigned his duties. He became manager of the Eastern Division Sales Office of the Dunham Company, in New York, in 1920, and prior to that he served in many important government appointments.

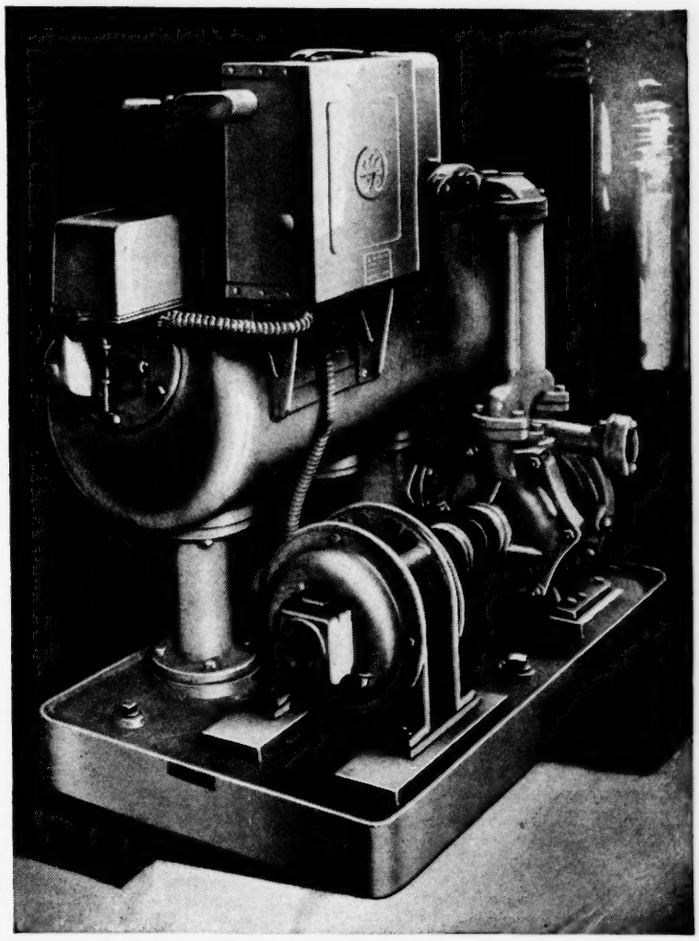
Manufacturers' Notes

Quaker Mfg. Co., Chicago, Ill., has appointed George M. Jensen as division manager. Mr. Jensen formerly was sales manager for the Hart Oil Burner Corporation.

Reading Iron Co., Reading, Pa., has appointed Douglas N. Davin to the Boston office of the company, which is under the direction of John G. Ross. Mr. Davin formerly was a member of the sales organization of Richardson & Boynton Co., New York.

Evins F. Glore & Son, New York, announces that Arthur J. Riordan, for ten years associated with the Richardson & Boynton Company in its Brooklyn territory, has become connected with its organization and will continue his headquarters in Brooklyn.

Tube-Turns, Inc., Louisville, Ky., reports additions to the plant itself and in equipment, which will increase the production of the company by 60%. Construction of the addition to the factory will be completed by the first part of July and the new equipment will be ready for operation by August 1.



Jennings Vacuum Heating Pump. Furnished in capacities of 4 to 400 g. p. m. of water and 3 to 171 cu. ft. per min. of air. For serving up to 300,000 sq. ft. equivalent direct radiation.

SEPARATE HANDLING *of air and water* is a real advantage!

The Jennings Vacuum Heating Pump consists of two independent pumping units. One pumps only water. The other handles only air.

Neither unit is ever called upon to handle air and water at the same time. Each is designed for maximum efficiency. The capacity of each remains constant regardless of the volume being pumped by the other. The total capacity of the pump never varies. It is the maximum capacity of the air unit plus the maximum capacity of the water unit. This is true of no other pump.

Jennings ratings, in square feet of equivalent direct radiation, are based on this combined air and water capacity. Each individual Jennings pump is tested at the factory to make certain that it will deliver simultaneously its full rated g. p. m. of water and cu. ft. per min. of air. When you install a Jennings, you can be sure that you have the right pump for the job. » » Write for Bulletin 85. » » The Nash Engineering Co., 81 Wilson Road, South Norwalk, Conn.

Jennings Pumps

Pittsburgh Tube Co., Pittsburgh, Pa., has appointed Frank P. Murphy as district representative in the Cleveland, O., territory, with headquarters in the Builders Exchange building.

Perfection Stove Co., Cleveland, O., has appointed the following representatives to handle Perfection oil burners: H. M. Ash, Paterson, N. J.; John H. Gessert, Menomonee Falls, Wis., and Vic J. Killian, Inc., 874 Central St., Winnetka, Ill.

Hess Warming & Ventilating Co., 1207 South Western Ave., Chicago, Ill., manufacturer of ventilating equipment and warm-air furnaces, is planning to erect a two-story factory building which will cost about $100,000.

Fairbanks, Morse & Co., Chicago, Ill., has completed a lease from the Western Warehousing Company for 30,000 sq. ft. of space at 323 West Polk Street at an annual rental of $12,000 for a term of ten years.

L. A. Harding Construction Corp., Buffalo, N. Y., is now located in its new offices at 612-616 Prudential Bldg., Buffalo.

Winslow Boiler & Engineering Co., 844 Rush St., Chicago, Ill., has requested its representatives to be in Galesburg during the week of July 7 or the week of July 14 to take advantage of the factory being turned over to them during these weeks The company believes that acceptance of this invitation will result in a better understanding of service problems and methods, lower costs of operating the representatives' service department and greater user cooperation.

Wagner Electric Corp., St. Louis, Mo., announces the addition of Herbert Hoover to its Philadelphia branch sales office. Mr. Hoover formerly was general distribution engineer for the Potomac Electric Power Company, which position he has held for the last seven years. Another announcement is that H. W. Petty was transferred from Detroit as branch sales manager for the Pittsburgh territory with headquarters in Pittsburgh.

Crane Co., Chicago, Ill., is planning to erect a large warehouse and showroom at Milwaukee, Wis. The building will be located on Capitol Drive at the Milwaukee road tracks, and will be of brick and steel construction.

Hart & Crouse Co., announces the election of James J. Lally as president of the company, succeeding Merwin K. Hart who has resigned. Mr. Lally for the last two years was vice-president and general sales manager of the company. Emmett J. Soder, associated with the company since 1917, and more recently in charge of the office and the manufacturing, has been elected vice-president and treasurer.

Jas. P. Marsh & Co., Chicago, Ill., has appointed John A. Thommes, formerly assistant superintendent, to serve in the capacity of superintendent, succeeding A. Trier, deceased.

Mineral Felt Insulating Co., Toledo, O., will hold its annual sales convention of distributors and dealers in Toledo, July 25-26, with an expected attendance of over 400.

Richardson & Boynton Co., 260 Fifth Ave., New York, has appointed E. I. Boardman as a member of its executive sales staff. Mr. Boardman, for a number of years, was connected with several branch offices of the American Radiator Company and recently was associated with the executive offices of the National Radiator Corp., at New York and Johnstown, Pa.

Wolf, Sexton, Harper & Trueax, Inc., engineers and architects in the Tribune Tower, Chicago, Ill., has changed its firm name to Wolf, Anderson, Harper & Trueax, Inc. Branch offices are at St. Charles, Ill., and Madison, Wis.

Armstrong Bros. Tool Co., Chicago, Ill., announces that Horace Armstrong, secretary and sales manager of the company, left on an extended business trip in Europe. He will visit twelve European countries, calling on Armstrong representatives.

Cashvel Utilities, Inc., 118 Jamaica Ave., Brooklyn, N. Y., held its first official opening with a dinner in the new showroom at this address, May 27. This company is distributor for the Grant oil burner manufactured by the Grant Mfg. Corporation, and the Curling Flame boilers, manufactured by the Jones Hollow-Ware Company.

Wayne Home Equipment Co., Fort Wayne, Ind., announces the appointment of Arthur W. Clark as director of sales in charge of all branch offices and individual territories, with headquarters at Fort Wayne. Mr. Clark has been associated with the company for fifteen years in the capacity of district manager at Boston, Mass.

The Prest-O-Lite Co., Inc., 30 East 42nd St., New York, announces the opening of a new plant for the manufacture of dissolved acetylene at 1240 Stewart Avenue, S.W., Atlanta, Ga., to take care of the demand by the increased use of the oxy-acetylene process in that industrial area. The old plant at 345 Kuhrt St., will discontinue operations.

Youngs Cornell Utilities, Inc., Rockville Centre and Great Neck, L. I., distributor for NoKol equipment, Thermal Art radiators and Taco Units, has acquired controlling and operating interest in Queens Cornell Utilities, Inc. of Jamaica, L. I., also NoKol distributors. Officers of the corporation are: Frederick T. Youngs, Jr., president; F. T. Youngs, vice-president; Ellis L. Redden, secretary and sales manager; Emil Henne, treasurer. W. Paulsen, formerly assistant treasurer of Cornell Utilities, Inc., is now associated with the Queens corporation.

Cook Electric Co., Chicago, Ill., announces that Edward I. Lassor will join its sales organization as its eastern representative. Mr. Lassor recently resigned as manager of the oil burner division of the Philadelphia Electric Company.

The Gorton Heating Corp., Garwood, N. J., announces a change in its management. The following board of directors has been elected: John L. Lehman, Lane McLean, and Harry F. Reynolds. John L. Lehman also will be president and treasurer of the corporation, and Clyde L. Ferguson will be secretary.

Turner Brass Works, Sycamore, Ill., has appointed R. S. Patten as its general sales and advertising manager.

G. M. Davis Regulator Co., Chicago, Ill, reports a change in its name to the Davis Regulator Co. A new factory building was completed at 2541 South Washtenaw Avenue to which all departments were moved on June 1.

Cutler-Hammer, Inc., Milwaukee, Wis., has purchased the assets of the Union Electric Mfg. Co., of Milwaukee, manufacturer of motor control specializing in a complete line of drum type control apparatus. The present factory of the Union company will be operated as a manufacturing division of Cutler-Hammer, Inc.

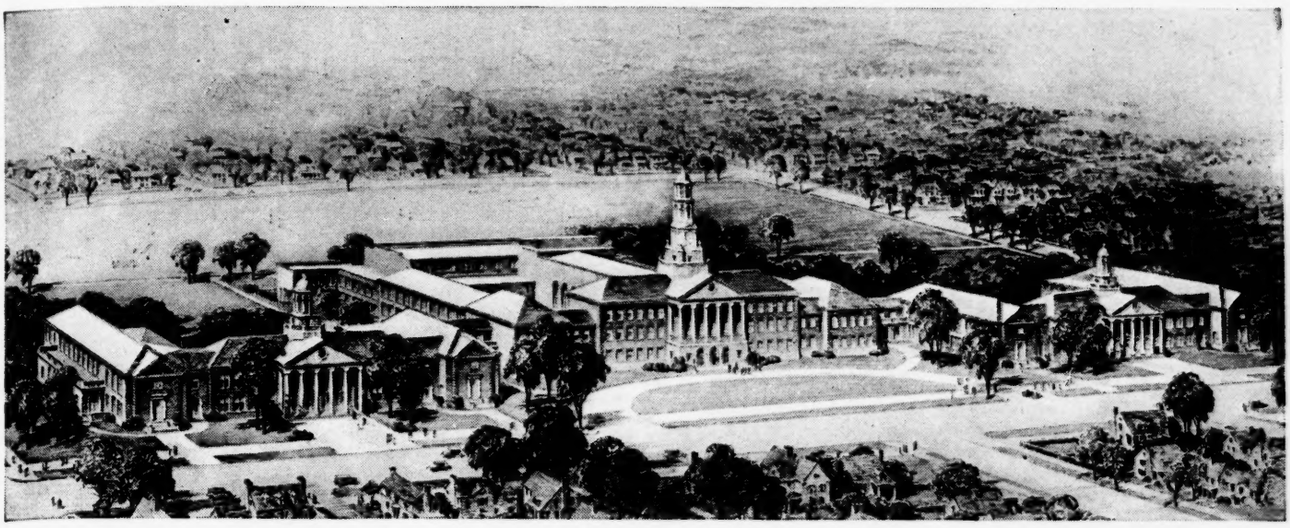
C. J. Tagliabue Mfg. Co., 18-88 33rd St., Brooklyn, N. Y., announces the acquisition of the American Tobacco Company property on Park Avenue, extending from Nostrand Avenue to Sanford Street in Brooklyn. The company will move from Bush Terminal, its present location, which will double its present facilities, providing approximately 300,000 sq. ft. of working floor space.

Changes of Address

Gorton Heating Corp., 96 Liberty St., New York, announces that its general offices have been moved to its factory at Garwood, N. J.

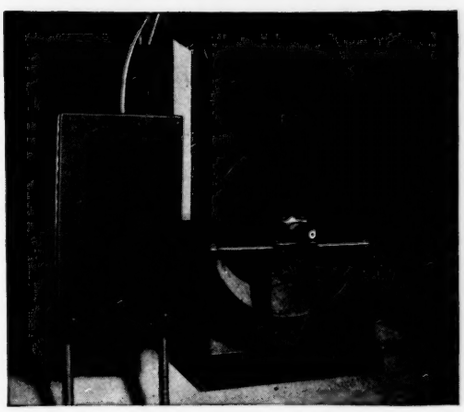
The American Arch Co., 17 East 42nd St., New York, manufacturer of air-cooled walls and suspended arches for boiler furnaces and industrial furnaces, announces the removal of its main offices from this address to the Lincoln Bldg., 60 East 42nd St., New York.

General Insulating and Mfg. Co., Alexandria, Ind., has changed its Brooklyn office to 370 Lexington Ave., New York City, with William C. Hyatt as manager.



World's Largest High School

...*equipped with* 32 Sturtevant Fans



TRENTON'S new high school is almost a university in size! This stately group of buildings is 975 feet long, 600 feet wide...and is planned for future additions. The 30-acre campus allows plenty of room for expansion!

Here, 3000 pupils will be enrolled every year. Every one of them will always have plenty of good air to breathe, wherever they are...in classroom, auditorium, restaurant, laboratory, pool, or gym. Healthful, refreshing air is circulated at the rate of 292,220 c.f.m. by 15 Sturtevant Silentvane Fans. Vitiated air is exhausted at the rate of 116,450 c.f.m. by 14 more Silentvanes.

Out in the power house, 2 Sturtevant Forced Draft Fans deliver 64,000 c.f.m. to the boilers. Even the incinerator is equipped with a Sturtevant Fan!

Wherever air must be moved...whether for heating, ventilating, or combustion...there is standard Sturtevant apparatus of typical Sturtevant high efficiency and sturdy construction to meet practically every requirement.

Trenton Central Senior High School, Trenton, N.J. Architects: Ernest Sibley and Lawrence C. Licht, Palisade, N.J. Engineers: Runyon & Carey, Newark. General Contractor: Karno-Smith Construction Co., Trenton. Heating and Ventilating Contractors: Murland Engineering Co., New York City.

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Main Offices: HYDE PARK, BOSTON, MASS.—CHICAGO, ILL., 410 No. Michigan Ave.—SAN FRANCISCO, CAL., 681 Market, St. *Branch Offices in Principal Cities.* Canadian Offices at: Toronto, Montreal and Galt. Canadian Representatives: Kipp Kelly, Ltd., Winnipeg. Agents in Principal Foreign Countries.

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Advertisements under this heading, $2 per inch, payable in advance. A 1-in. advertisement contains 35 words.
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HEATING AND VENTILATING—521 Fifth Ave., New York City.

PRECISION

is a synonym for our service when we are mentioned by the Heating and Ventilating industry. The exactness of our operating methods in research has been given the stamp of national recognition by those whom we have served in the past.

All branches of Heating, Ventilating, Air Conditioning, District Heating and allied problems find ready reference in our completely equipped Laboratories. Correspondence from manufacturers, architects and engineers is cordially invited, and assurance is given of our fullest co-operation.

FROST
RESEARCH LABORATORY
INCORPORATED
1326 Markley Street NORRISTOWN, PA.

—WANTED—

Manufacturer's Representatives

We have several openings for high class representatives to contact distributors and dealers, having exclusive selling franchises on the Wayne Oil Burner and Wayne Electric Refrigerators. Applicant must have successful record in sales together with sound engineering education. An unusual opportunity for men handling not in excess of two or three non-competitive lines. State full details of experience, territory desired and companies represented at the present time.

WAYNE
HOME EQUIPMENT CO.
FORT WAYNE, IND.

BIG BUSINESS SAYS!

"Prepare NOW to reap YOUR share in the coming years of great business Prosperity."

HARKEN to this Command, O Ye Shop Owners, Salesmen, Mechanics, and others. Fortunes will be made in these next few years by those who KNOW. Devote this Summer to personal preparation in a technical way for going after the bigger paying jobs—the ones with the larger yearly incomes. Build big with big prosperity; our Engineering Service is at your command. Check the subject you prefer, and mail today—full information is free.

- ☐ Heating and Ventilating Engineering.
- ☐ Special Steam and Water Heating.
- ☐ Scientific Warm Air Heating.
- ☐ Plumbing and Sanitary Engineering.
- ☐ Contracting and Estimating.
- ☐ Mechanical Drafting.

Saint Louis Technical Institute
Est. 1910.
The most thorough institution for Technical Home Study to-day.
4543 Clayton Avenue St. Louis, Mo.

Heating, Ventilating
or Refrigeration
Specialty Sales

REPRESENTATIVE WANTED

If you call on plants and factories in your territory and you are in position to take on another good line, you can make a profitable arrangement with a mid-west unit heater and cooler manufacturer seeking representation.

Write fully, giving details of territory covered and lines carried as well as personal information.

D. J. MURRAY MFG. CO.
WAUSAU, WIS.

Heating and Ventilating Sales Engineers with successful sales experience in fan industry wanted. Address application to Box 118, care of Heating and Ventilating.

FOR SALE: Two American Type "A" used boilers, size 3-A-12, with a capacity of 7,000 square feet. For hard coal, coke or stoker firing. The W. R. Rhoton Co., 1305 E. 107th St., Cleveland, Ohio.

The New York Blower Company requires successful and experienced fan and unit heater salesmen. For further information address The Sales Manager, 3155 Shields Avenue, Chicago, Ill.

NEW OFFICE

GENERAL INSULATING & MANUFACTURING CO.

Manufacturers
Gimco Rock Wool Insulating Products

As Further Service to East and Foreign Customers—have established

A NEW YORK OFFICE
370 Lexington Avenue
William C. Hyatt, district & export mgr.

Steel Heating Boiler Company with very complete lines has some territory open for sales organization or representative having had experience calling on engineers, architects and heating trade. Address Box 119, Heating and Ventilating.

SALES REPRESENTATIVE WANTED—An excellent opportunity with unlimited financial possibilities, either as direct salesmen or as sales representatives, is offered covering a complete line of vacuum, vapor and steam heating specialties, a complete system of temperature regulation, fans, air washers, and unit heaters. Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with. etc. Applications confidential.

THE BISHOP & BABCOCK SALES CO.
Cleveland, Ohio

Increased Activity in rapidly expanding markets has made it necessary to increase the number of our representatives. Sales engineers experienced in these or similar lines are invited to write. If your territory is open, this may mean a valuable connection.

JAS. P. MARSH & CO.
Division of Commercial Instrument Corp.
2073 Southport Avenue, Chicago, Ill.

Have You Bought Your 1930 A. S. H. and V. E. Guide?

THIS year's edition was much larger than any previous one but the material in it has had such an unusual appeal that the supply is almost exhausted. *The Guide* is indispensable to those who want to keep posted on the latest developments in the field. It has over 1000 pages, 6 x 9 inches in size and is well illustrated. A glance at the chapters listed below will give some idea of its scope.

CONTENTS BY CHAPTERS:

1. Codes and Standards; 2. Heat Losses from Buildings; 3. Standards of Ventilation; 4. Ventilating Systems; 5. Heating with Warm-Air Furnaces by Gravity; 6. Heating with Warm-Air Furnaces by Fan Pressure; 7. Air Conditioning and Cooling; 8. Air Cleaners; 9. Unit Heaters and Air Conditioners; 10. Heating by Coal; 11. Heating by Gas; 12. Heating by Oil; 13. Heating by Electricity; 14. Chimneys; 15. Boilers; 16. Conductors and Convectors for Steam and Hot Water Heating; 17. Automatic Heat Control; 18. Pipe and Fittings; 19. Pumps and Traps; 20. Piping for Steam Heating Systems; 21. Piping for Hot Water Heating Systems; 22. Piping and Equipment for Laundries, Kitchen and Hospital Service; 23. Water Supply Piping for Buildings; 24. Heat Insulation for Pipes and Surfaces; 25. District Heating; 26. Selection of Fans and Motive Power; 27. Air Ducts; 28. Pneumatic Exhaust Systems; 29. Drying by Evaporation; 30. Ozone and Ventilation; 31. Notes on Requirements for Special Types of Buildings and Service; 32. Specifications; 33. Physical Properties, Weights, Measures, etc.; 34. Symbols.

Enclosed find $5.00 for one A. S. H. & V. E. Guide

Bound in Flexible Fabrikoid, Only $5.00, Delivered

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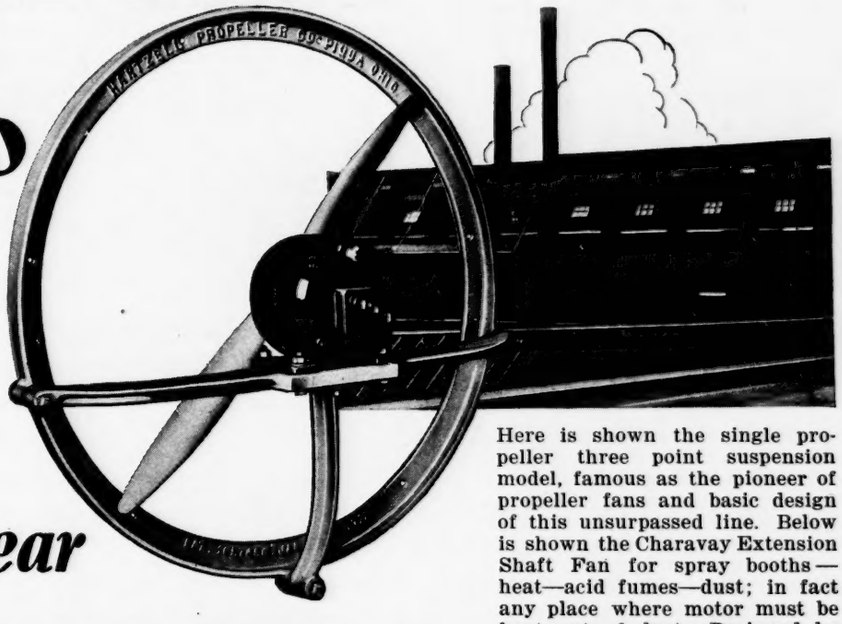
Doing the Job

40% Better

and Saving $7000.00 a year



Here is shown the single propeller three point suspension model, famous as the pioneer of propeller fans and basic design of this unsurpassed line. Below is shown the Charavay Extension Shaft Fan for spray booths—heat—acid fumes—dust; in fact any place where motor must be kept out of duct. Designed by the same aeronautical engineer who designs all Charavays.

No matter what your ventilating problem, Charavay Fans will cut the cost tremendously. The savings in a single month are no small sum—in a year *real* capital!

Take the problem of Central Tube Company—that of exhausting terrific naphtha fumes from dipping ovens. Here was a task necessary to the welfare of employees and imperative to production schedules. It had to be done regardless of cost; and before Charavay engineers were consulted, the cost was almost provocative. A jet blower and steam was used with two draft stacks connecting three ovens in the basement. It cost 80c an hour to operate on a 24 hour day schedule, and at its best was inefficient.

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Belanger Fan & Blower Co.,
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Cross Ventilation Co.,
228 N. LaSalle St.,
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G. S. Faries,
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The Wm. P. Little Co.,
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Carrol B. McGaughey,
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Missouri Ventilating Equipment Co.,
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Northwestern Fan & Blower Co.,
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The Pittsburgh Elec. & Mach. Works,
1 Barker Place,
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Ralph Sprenger,
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Steen Fan & Blower Co.,
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The J. W. Thompson Co.,
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Ventilating Equipment Co.,
1601 St. Clair Ave.,
Cleveland, Ohio.

The F. M. Webber Co.,
1260 Graybar Bldg.,
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Western Ohio Ventilating Co.,
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CHARAVAY PROPELLER TYPE FANS

CUT THE COST FROM 80 CENTS AN HOUR TO 50 CENTS PER DAY!

Charavay Propeller-Type Fans were recommended and the installation was made like this: 100" was cut off of the two stacks, the stack top was closed and at each top was placed a ½ H P. Charavay Extension Shaft Fan. NOW the exhausting of the fumes is 40% more efficient than before and *the cost of operating the two Charavay Fans is around 50c a day.* A difference of $18.70 every 24 hours—a saving of almost $7,000.00 in one year. . .

No more steam to rust out costly stacks . . . no danger of explosion, for fan parts of aluminum create no sparks . . . savings enough to make stockholders smile . . . and the cost of the Charavay Fans is insignificant compared to the gain.

A Type and Style for Every Ventilating Need Today

HARTZELL PROPELLER FAN CO. Div. of Hartzell Industries, Inc. 716 CRAFT STREET **PIQUA, OHIO**

The Business Paper . . .
and
the Open Mind

"SHOW me a business that has ceased to think" says John Moody, famous economist and investment advisor, "and I'll show you a firm that is on the down grade. Show me a concern where ideas are no longer welcome and I'll show you one that is getting ready to die of dry rot. Show me a company that has cut itself off from the stimulation of other men's thought and other men's knowledge and I will show you a firm whose days are numbered."

And on the other hand, wherever you find a healthy, progressive corporation you will find the open mind. You will sense an alertness to know and use the experience of others. Almost inevitably you will discover that executives regularly and systematically read the business papers of their own and related fields. Indeed, it is a fact, striking in the frequency of its recurrence, that outstanding firms make a policy of requiring executives to follow business papers for new ideas, new facts, new developments. From such a policy springs the perennial resourcefulness that brings success.

The business press of today does more than any other single factor to keep business on its toes. Leading thought, improving methods, continually adding to the available store of exact working information, the business press performs a very real service to the Nation.

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John Moody is among the best known of economists and financial advisors. As a writer on business subjects he is scarcely less well known than as President of Moody's Investors' Service, investment counsel to many great financial interests. A keen analyst of businesses as investments, few men have better opportunity to evaluate progressive management as a factor in success, or to observe the outstanding part played by technical, industrial and merchandising papers in the development of modern business.

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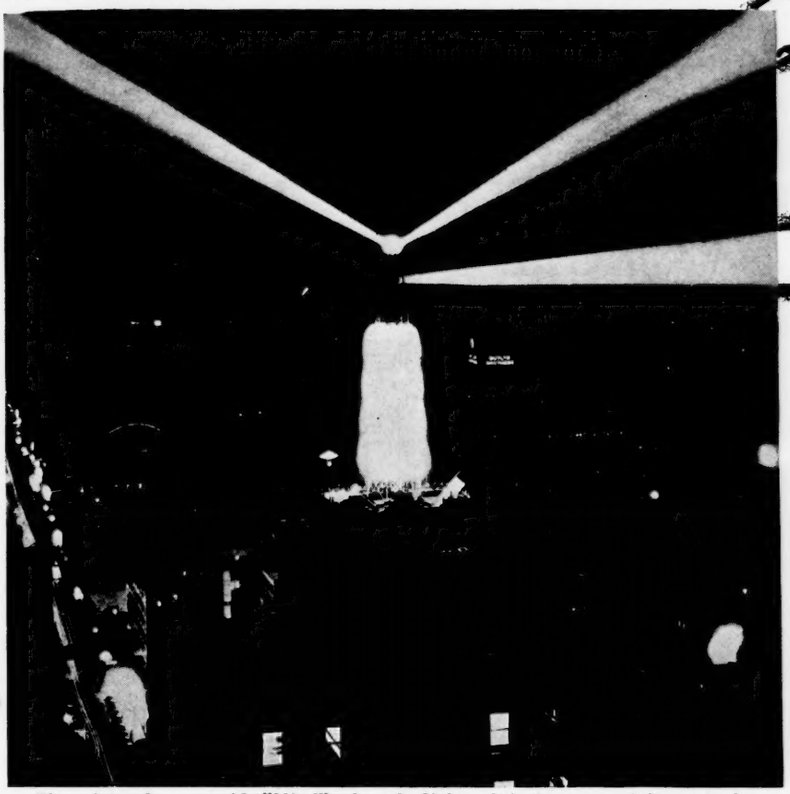
TWO-NINETY-FIVE MADISON AVENUE · NEW YORK CITY

THESE NIGHT LIGHTS MUST NOT TREMBLE



The aviator does not ride "blind" when the lights of the beacon aerial are steady.

. . . Even the flicker that vibration could cause must be carefully avoided

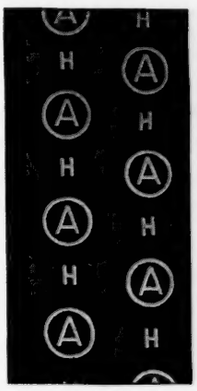
AVENUES of light, from aerial beacons, paving the darkness, direct the aviator to his destination. Lives depend upon these beacons. They dare not falter. So the land light-house must guard them with every possible protection.

Even the vibration of moving machinery must not threaten light failure. These moving machines must be cushioned. If they are cushioned with Armstrong's Cork Machinery Isolation, carefully installed, their vibration is adequately absorbed.

If this is a dramatic use of Armstrong's Cork Machinery Isolation, there are scores of conditions where the cork-cushioning plays a routine, yet extremely important, part. Wherever there is moving machinery—in factories, office buildings, hotels—vibration and noise can be deadened.

Armstrong's (A) Product

On a cork foundation, a machine runs more quietly, smoothly, and efficiently. It is protected against hastened depreciation. So are nearby machines, gauges, and precision instruments. And the building structure, too.



Plainly marked—Circle A for Armstrong: "H", "M", or "L" for the density.

Almost any machine can be quieted in this manner. Armstrong's Cork Machinery Isolation is made in three densities and seven thicknesses. This permits an exact adjustment to almost any operating condition. And the treatment is permanent!

For just a few dollars efficient isolation is assured. We suggest that you study your building. You'll find many places where cork cushioning is needed. If you prefer, Armstrong engineers will be pleased to make recommendations as to proper density and thickness. Armstrong Cork & Insulation Co., 925 Concord St., Lancaster, Penna.

Armstrong's Cork Machinery Isolation

Adequate for all these:

Armstrong's Cork Machinery Isolation is used for: air compressors, blowers, drill presses, drop hammers, elevator hoists, engines, fans, forging machines, machine tools, motors, printing presses, pumps, punching machines, refrigerating machines, vacuum cleaners, and similar apparatus.

IRON BODY GATE VALVES

SCREWED, FLANGED
AND
HUB END STYLES

NON-RISING STEM
AND
O. S. and Y. PATTERNS

ALSO MANUFACTURERS OF

Cast and Malleable Iron Fittings
Brass Valves and Fittings

Illinois Malleable Iron Company

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WHY TAKE A CHANCE?

Especially when it means risking the life of your boiler? A little precaution in the beginning saves costly replacements and inconvenience. A boiler that is unguarded against burning or cracking will last for a short time only. The Thermo Syphon Trap protects your boiler by returning all condensation to the boiler, maintaining the water line, regardless of pressure or vacuum. It prevents the burning or cracking of the boiler due to the water leaving the boiler or becoming locked in the system. Insures noiseless operation. Approved by heating engineers and used with success on prominent patented Vapor, Vacuum, Atmospheric and Modulation Systems.

Send for Bulletin No. 16-H. V., giving full details

THERMO SYPHON TRAP

LYTTON
MANUFACTURING CORPORATION
FRANKLIN, VIRGINIA

FOR ALL TYPES OF
STEAM HEATING SYSTEMS

CARBORUNDUM

REG. U. S. PAT. OFF.

Announces

The CARBORADIANT

REG. U. S. PAT. OFF.

OIL BURNER

WITH THE CARBOFRAX RADIANT FIRE RING

REG. U. S. PAT. OFF.

A ROTARY type burner developed through painstaking research—rigorously tested in the most convincing of oil burner laboratories—the homes of many satisfied users. The Carboradiant Burner is now offered by The Carborundum Company for distribution in New York and suburban area including Long Island, Northern New Jersey, Westchester and Lower Connecticut.

¶ Completely automatic, this burner is unusually efficient, safe and quiet—economical, easy to install and simple to service.

Dealer Applications will receive Prompt Consideration

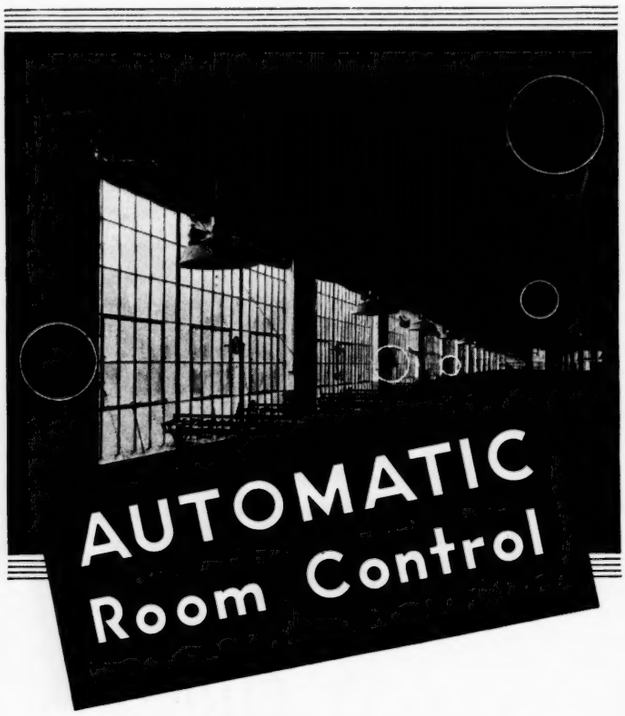
THREE MODELS TO MEET EVERY HEATING REQUIREMENT

Listed as standard by Underwriters' Laboratories; approved by New York Board of Standards and Appeals, by the Massachusetts Board of Public Safety and by insurance and municipal authorities wherever installed.

The CARBORUNDUM Company

Oil Burner Division

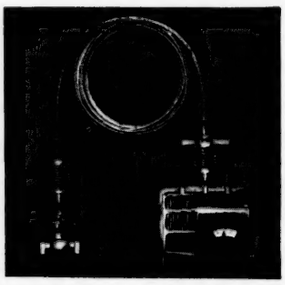
PERTH AMBOY, NEW JERSEY



Under or overheating — means loss of health, loss of wages, loss of material, loss of profits—and it helps nobody. Stop this senseless waste by installing a Sylphon Regitherm that will automatically, and accurately maintain the temperature you desire 24 hours every day, year in and year out, with very little attention.

The Sylphon Regitherm is made in many types and sizes to fit your particular requirements. Thousands of installations in the past 16 years attest to the accurate performance and serviceability of this type of temperature controller.

If you wish to know more about the Sylphon Regitherm and what it can do for you, write for Bulletin NH-No. 175. No obligation.

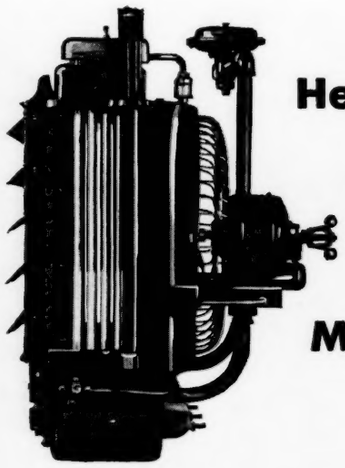


Sylphon NO.11
REGITHERM

The Regitherm provides the easiest and most practical means for controlling temperature of dry rooms of all descriptions which should be maintained at certain temperatures; cotton warehouses; and for the control of air currents in fan and duct systems. Also for control of cold storage rooms where calcium chloride brine is used for the cooling medium.

FULTON SYLPHON Co.
KNOXVILLE, TENN., U.S.A.

Representatives in all Principal Cities in U. S. A., European Representatives, Crosby Valve and Eng. Co., Ltd., 41-2 Foley St., London, W. I., Eng., Canadian Representatives, Darling Bros., Ltd., 140 Prince St., Montreal, Que., Canada.



Here's Modern Heat For Industry In Its Most Efficient Form

The Humphrey Gas UNIT HEATER

There is no boiler room when you use Humphrey Gas Unit Heaters in your plant. There is no coal pile. There is no non-productive boiler room crew drawing pay. You have heat when you want it and where you want it . . . heat in its most efficient form when you specify Humphrey Gas Unit Heaters . . . for gas is the most flexible, economical and the cleanest fuel that there is. You can use for profitable purposes the space the boiler room used to take. You increase the cleanliness of the entire plant when you eliminate the coal pile. Because Humphrey automatically maintains a proper scientific temperature at all times, employees are able to work more efficiently . . . and you save money by being able to concentrate the heat, shutting it off in idle parts of the plant, keeping it up only where men are actually working. Write for the Humphrey catalog.

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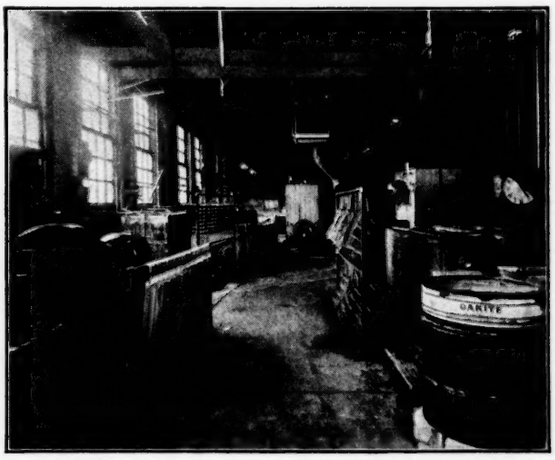

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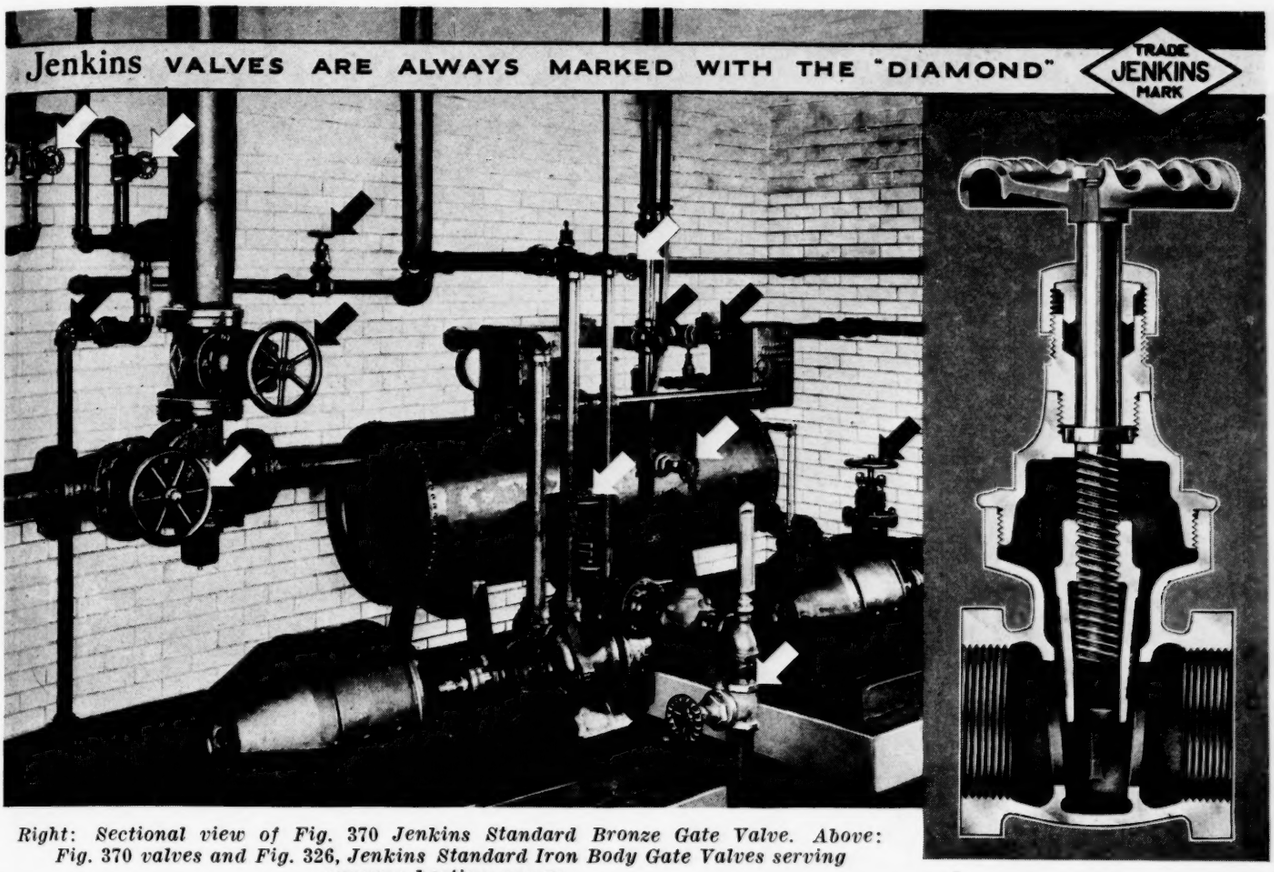

Right: Sectional view of Fig. 370 Jenkins Standard Bronze Gate Valve. Above: Fig. 370 valves and Fig. 326, Jenkins Standard Iron Body Gate Valves serving vacuum heating pumps.

For quick, time-saving installation

For the contractor, as well as the building owner, there are advantages in installing Jenkins Valves. Not only are Jenkins made to yield the owner the maximum of efficient low-cost valve performance, but they are made also for quick, time-saving installation. Fitters like to work with these sturdy, precision threaded valves. Jenkins go in easily. And the finished job satisfies both the contractor and the owner.

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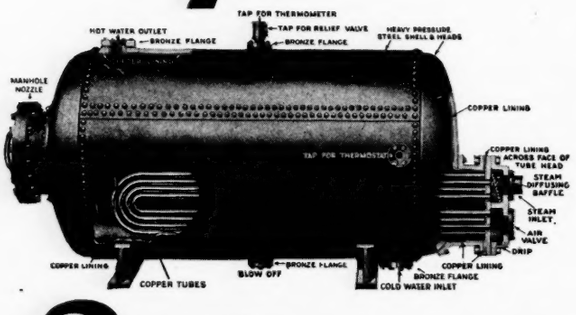

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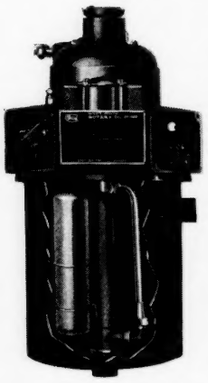

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ON PAGE 132 IN THIS ISSUE

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. . . from an economical thickness of material

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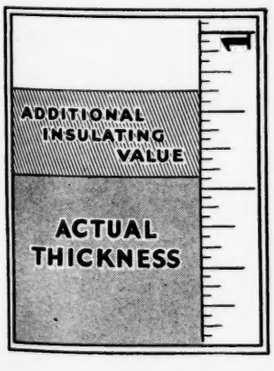

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For large quantities of hot water and where floor space is limited, the Paracoil Vertical Type Storage Water Heater is recommended.

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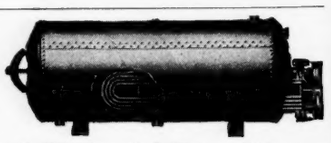

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Immediate supply of hot water and plenty of it, can be relied upon when furnished by the Paracoil U-Tube or Instantaneous Type Water Heater.

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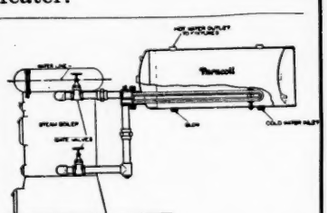
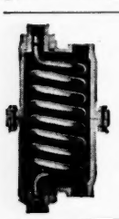


Taking the place of the separate storage tank and heater, the Paracoil small type storage water heater is especially designed for the apartment house of approximately 10 families.



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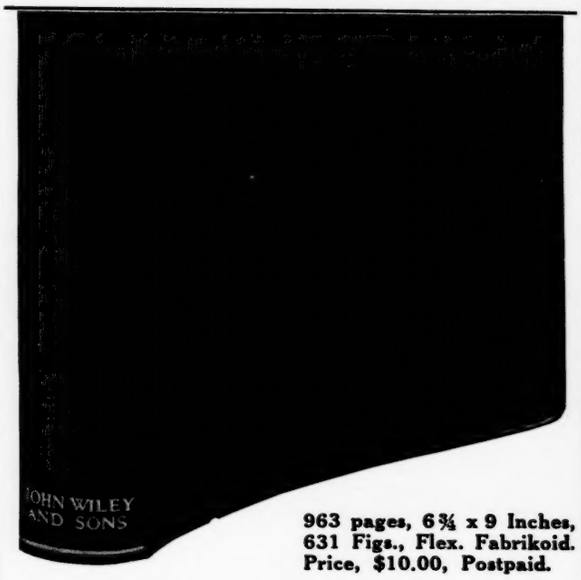

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Compactness
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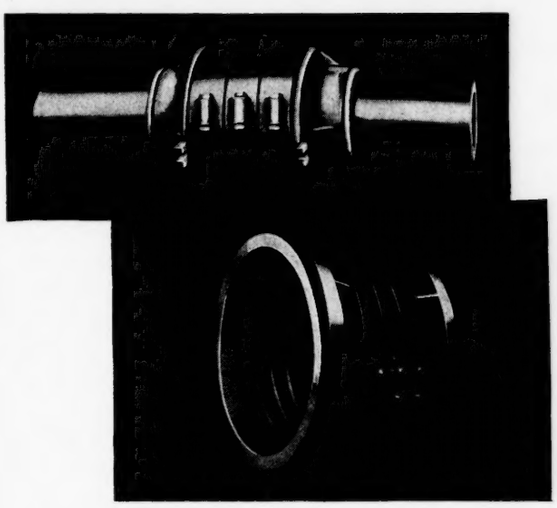

LITTLE further need be said about these five Badger Joint features. They are self-explanatory. They mean lower-cost conveyance of steam.

That engineers and operating officials are fully aware of this is evident by the constantly increasing call for Badger Joints.

Several companies have installed hundreds of these joints. One company already has well over 3,000 and continues to order Badger Joints when extending its heating lines.

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The Steam Fitter Must Take Things As He Finds Them

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Here's a boiler just built to meet conditions. It does not ask to have conditions made for it.

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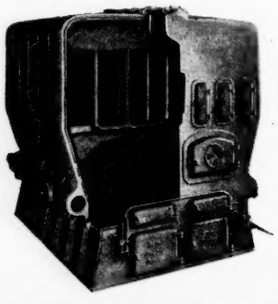

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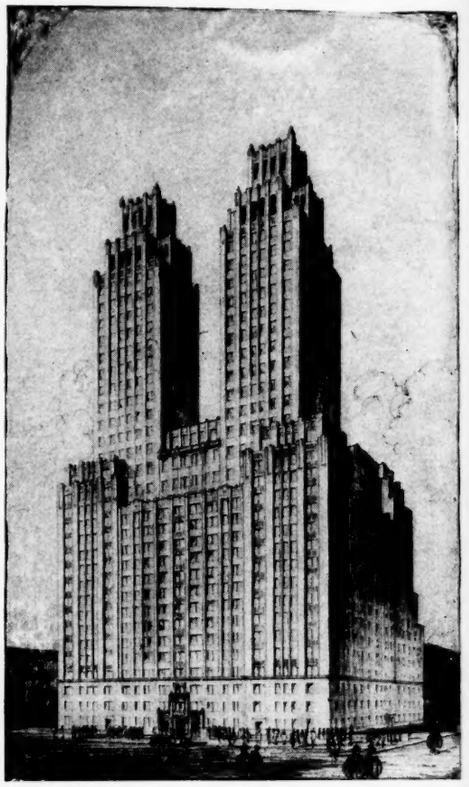

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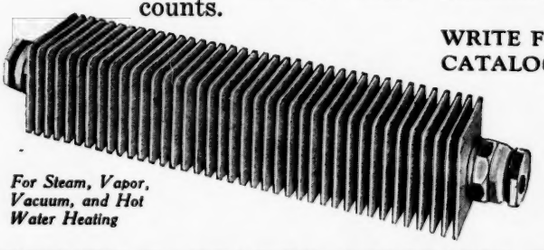

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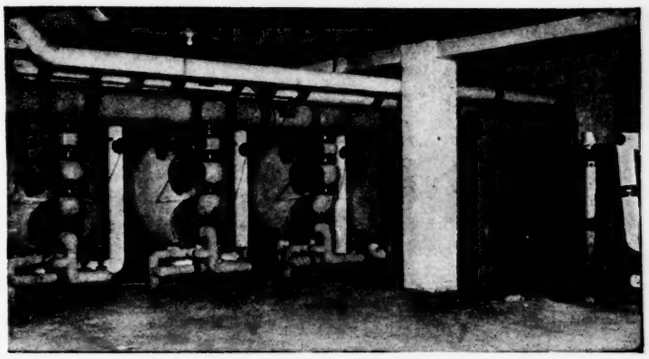

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Whitlock Heaters are correctly designed, properly proportioned, and carefully built for the service for which they are recommended.

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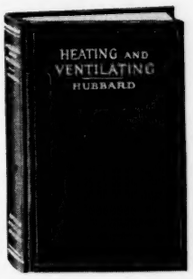

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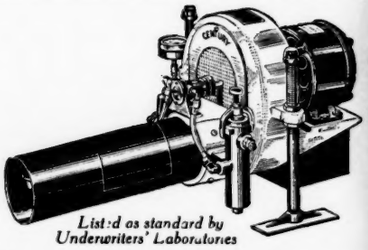
Made by the makers of Emerson 1/30 to 2 h. p. motors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Also Manufacturers of E-Z INSERT

Four Tons of Dust in Air, New York's Big Problem

Engineers Told by Prof. Free of Ever Present Menace to Health

The solution of the dust problem in scientific minds, Prof. R. E. Prue of New York University declared to-day before the 2,000 delegates at the fifteenth annual convention of the American Society of Mechanical Engineers at the Engineering Societies' Building, No. 29 West 39th Street. The convention, which opened yesterday, will continue until Friday.

From four to five short tons of dust particles are continually floating through the atmosphere of the city, said Prof. Prue, who arrived at this conclusion after a recent survey in which dust and soot particles were counted by a dust counter. This device was slightly modified from the instrument used by Dr. J. S. Owens, of London, in various tests of dust conditions in the British capital, the speaker said.

The majority of Prof. Prue's tests, he said, were made from the 17th floor of a building at Fifth Avenue and 32d Street. His investigation developed that soot comprised at least 20 per cent. of the solid particles ordinarily encountered in the atmosphere about the city.

Apartments and homes were responsible for the vast amount of soot he said, and not the large power houses and other industrial plants, as is often charged. Other materials observed during the tests were particles of rubber from automobile tires, sulphur, brief and fast dust, slivers of glass, The glass particles, he said, were presumed to be minute flakes scaled from the tile used in building.

"Little practical importance attaches to the calculations of the total amount of suspended soot in the city air," he said. "It may be said, however, that the average over New York City on the basis of my counts appears to be one ounce avoirdupois for each 10,000,000 cubic feet of air. For the air over the entire city the amount is from four to five short tons."

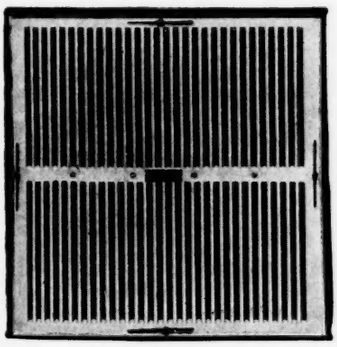
WASHINGTON'S KIN MEETS AN

Clean Air Saves Thousands

The dust and soot in unfiltered air add thousands of dollars a year to the cleaning bills of hotels, department stores and other large buildings. Moreover, dirty air ruins paint and furnishings, and carries deadly disease germs.

Help your clients eliminate these unnecessary expenses by installing a Protectomotor Panel Air Filter, which delivers air that is 99-9/10% clean. This filter will save its cost in a year or two.

It operates two months or more without cleaning, and can be cleaned in a few minutes per panel with our special vacuum cleaner.



The initial cost is low and the operating cost small, as no oil drains or cleaning tanks are required.

This filter maintains the resistance below any specific static pressure drop.

Over 350,000 Protectomotors are in use.

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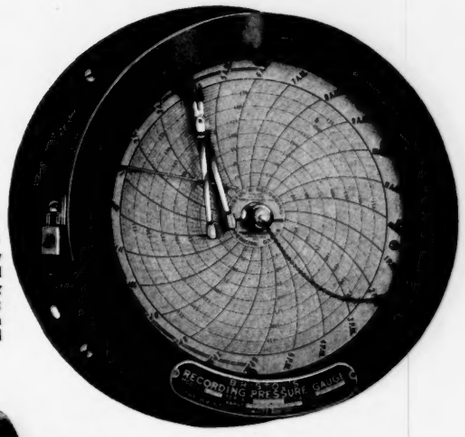
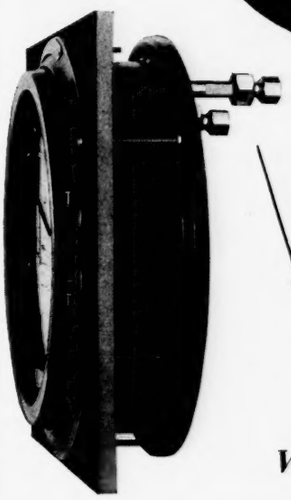
Recording

Instruments

Illustration below is Bristol's Round Form Recording Gauge Model 43; designed for flush mounting on panel board.





Bristol's Round Form Recording Pressure Gauge Model 41. Inverted penarm is standard; single or multiple pens can be furnished as desired. Case is made of non-ferrous metal, and is of moisture-proof and dust-proof construction. Standard finish is black enamel.

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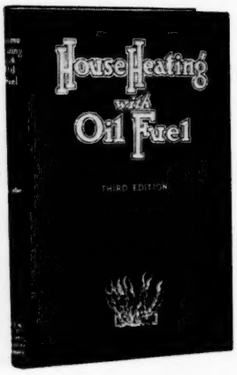

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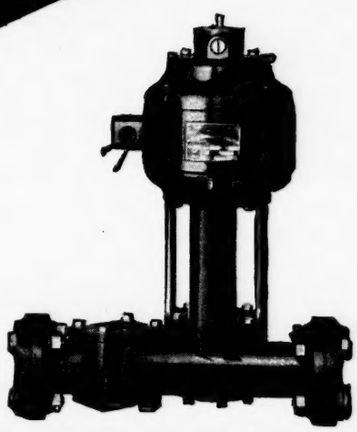

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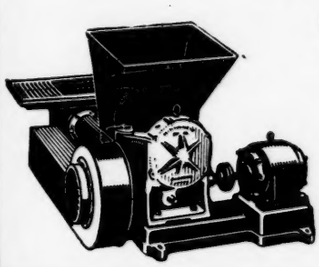

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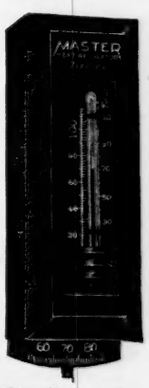

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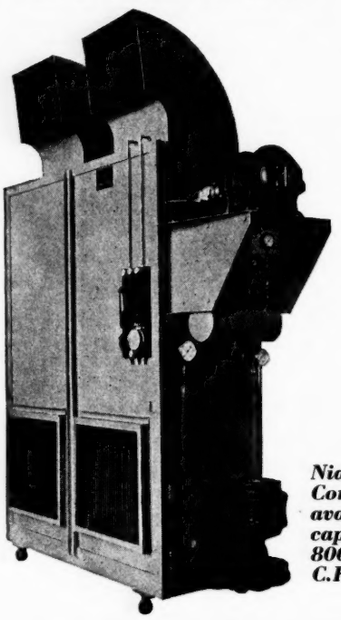

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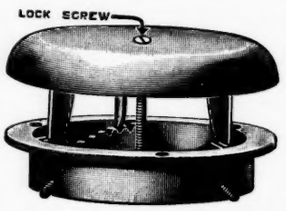

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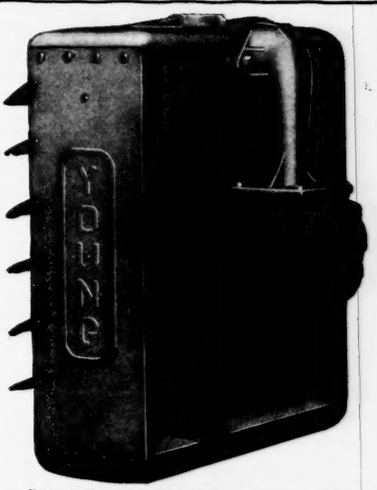

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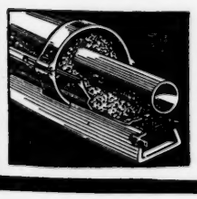

Sectional view Ric-wiL Type F, showing Loc-liP Side Joint, pipe support and Dry-paC packed around pipe.

After trench is graded, lay Ric-wiL Base Drain end to end like dominoes—the center bead serves as an alignment guide. Wedge Pipe Support saddles between every sixth section.

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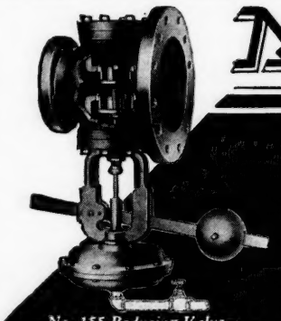

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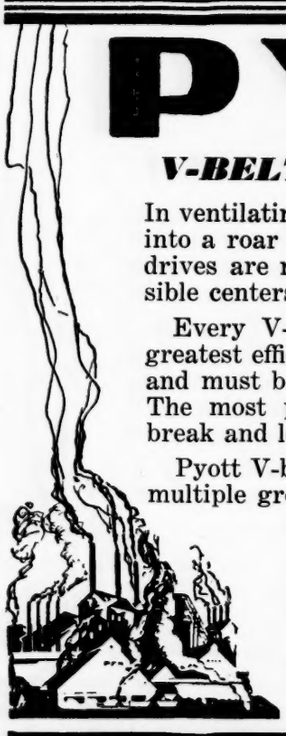

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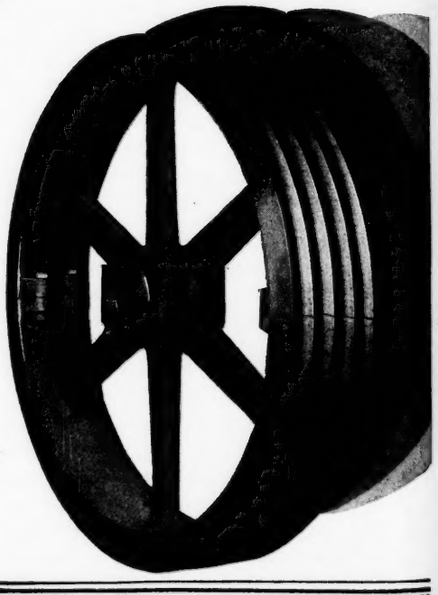

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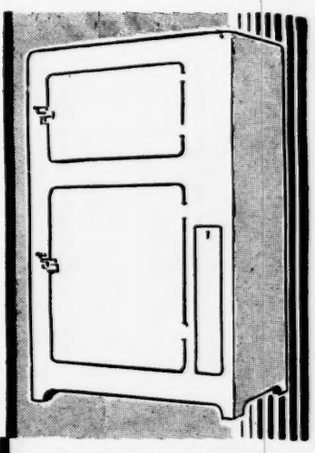

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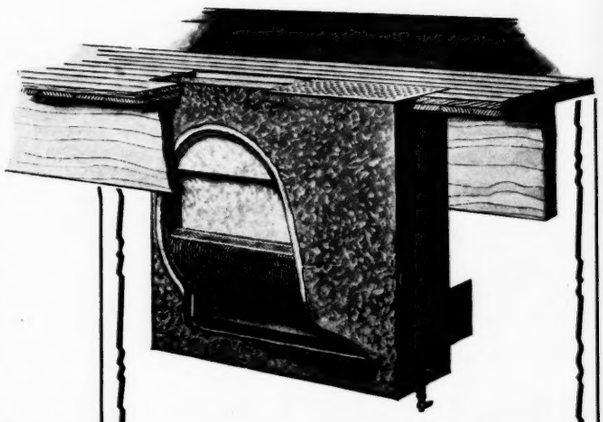

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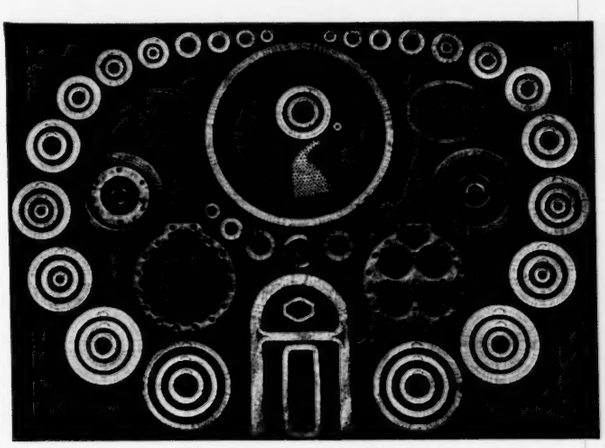

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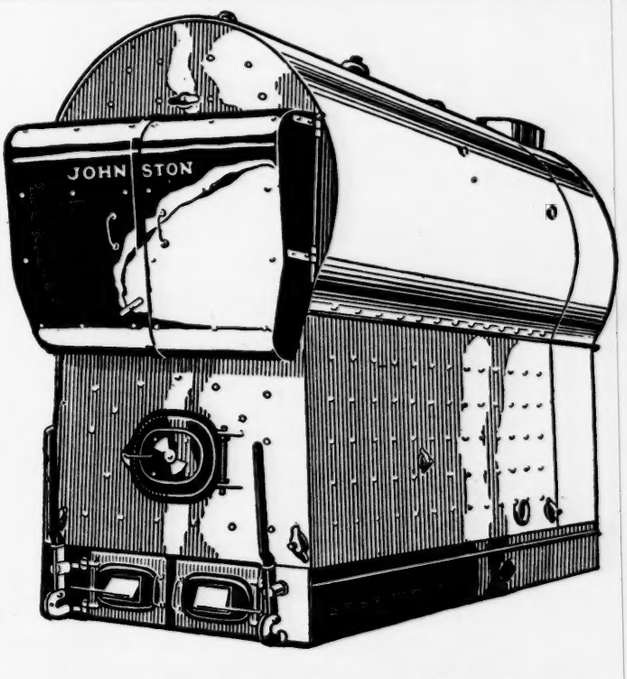

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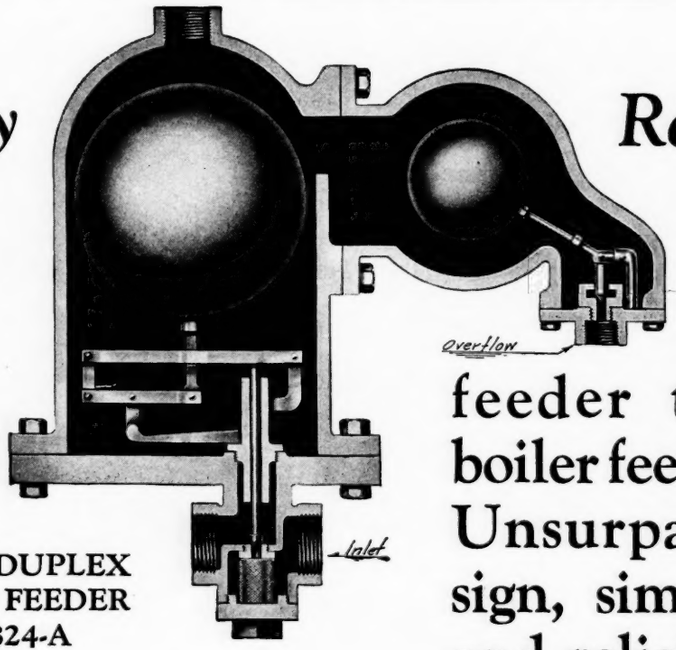

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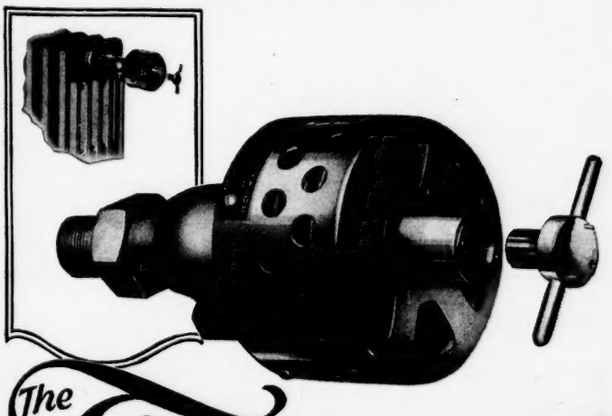

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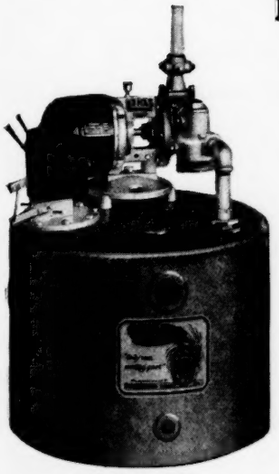

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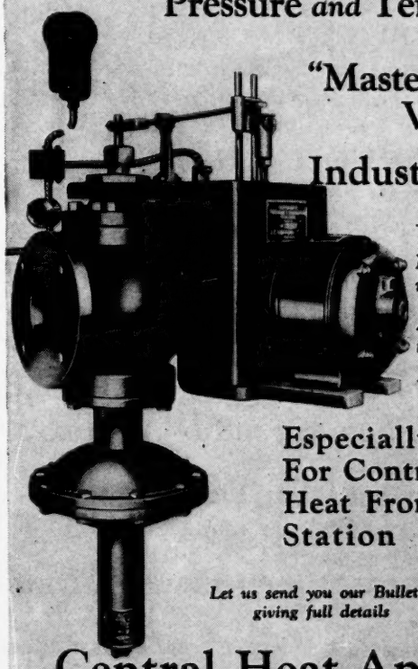

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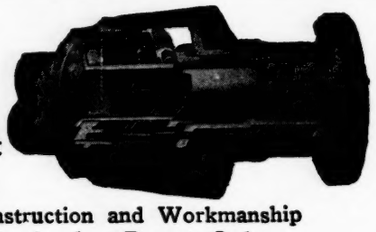

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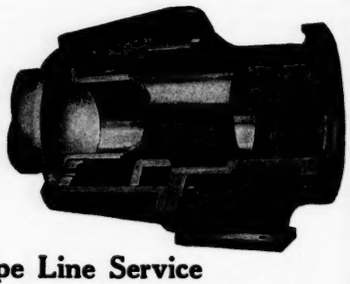

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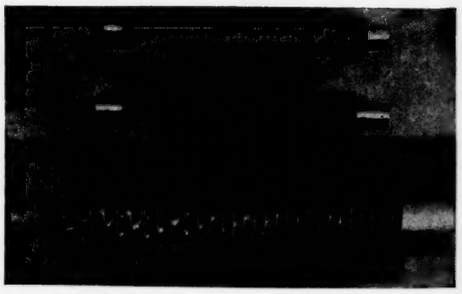

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Davis Engineering Corp., New York.

FILTERS, FEED-WATER
Davis Engineering Corp., New York.

FITTINGS, ACID RESISTING
Crane Co., Chicago, Ill.

FITTINGS, PIPE, FLANGED
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FITTINGS, PIPE, SCREWED
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FLANGES
Crane Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Walworth Co., New York.

GAS BURNERS (CONVERSION TYPE)
Barber Gas Burner Co., Cleveland, O.
Columbia Burner Co., Toledo, O.
Roberts-Gordon Appliance Co., Buffalo, N. Y.

GASKETS, ASBESTOS
Crane Co., Chicago, Ill.
Goetze Gasket & Packing Co., New Brunswick, N. J.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.

GASKETS, METALLIC
Crane Co., Chicago, Ill.
Goetze Gasket & Packing Co., New Brunswick, N. J.
Jenkins Bros., New York.

GASKETS, RUBBER
Crane Co., Chicago, Ill.
Goetze Gasket & Packing Co., New Brunswick, N. J.
Jenkins Bros., New York.

GAUGE BOARDS
Bishop & Babcock Sales Co., Cleveland, Ohio.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGE GLASSES
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGES, ALTITUDE
American Radiator Co., New York, N. Y.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, COMBINATION PRESSURE AND ALTITUDE
Bristol Co., Waterbury, Conn.
Marsh, Jas. P., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Mercoid Corp., Chicago, Ill.

GAUGES, DRAFT
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.

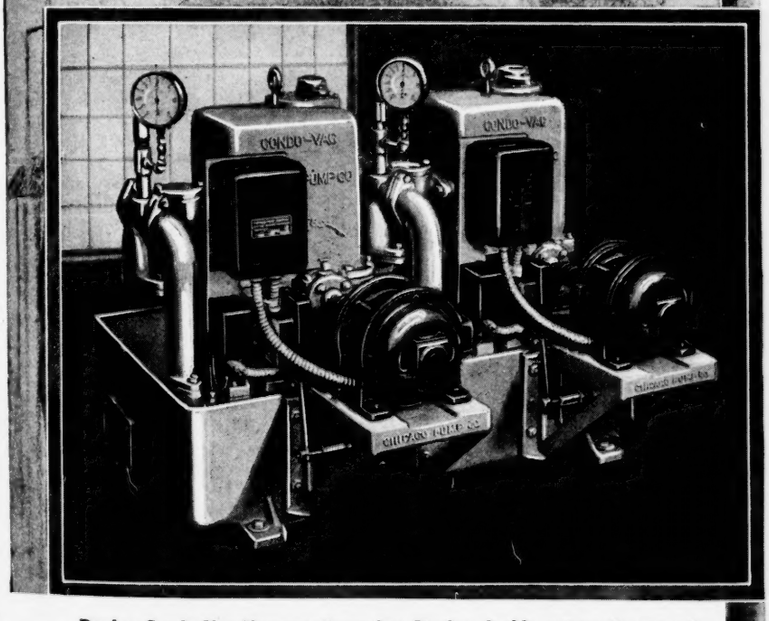
GAUGES, HYDRAULIC
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, PRESSURE
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.

GAUGES, VACUUM
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

CHICAGO PUMPS

Used in the Leading Buildings of America



Duplex Condo-Vac Vacuum Pump has Duplex double automatic control.

The "CONDO-VAC" Vacuum Pump

Over 2000 Condo-Vacs in use and not a single failure!

Here's Why –

1. Ample clearance between port and vacuum impellers assures "sustained efficiency" and long life.
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3. The absence of a closely fitting rotor avoids the rapid drop in efficiency common with some makes of pumps.
4. 21 years' experience in building high grade pumps lies behind "Condo-Vac" design.

Sustained Capacity!

yesterday, today and for many years to come — — —

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BILGE-FIRE-HOUSE-VACUUM

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Chicago

New York Office
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New York City

Detroit Office
3-128 General Motors Building

Since 1909!

Builders of High Quality Pumping Equipment

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Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, VOLUME
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

GAUGES, WATER
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Walworth Co., New York.

GENERATOR COOLING SYSTEMS
American Air Filter Co., Louisville, Ky.
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

GOVERNORS (PUMP)
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Watts Regulator Co., Lawrence, Mass.
Webster & Co., Warren, Camden, N. J.

GRATES, DUMPING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, ROCKING
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING AND DUMPING
Frost Mfg. Co., Galesburg, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING, CIRCULAR
Fitzgibbons Boiler Co., Inc., New York.

GRATES, STATIONARY
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEAT CABINETS
(See Radiators, Cabinet and Concealed)

HEATERS, AIR, FAN SYSTEM
Aerofin Corp., Newark, N. J.
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Modine Mfg. Co., Racine, Wis.
New York Blower Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.
Wing Mfg. Co., L. J., New York.
Young Radiator Co., Racine, Wis.

HEATERS, DOMESTIC WATER
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E. Buffalo, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
McDermott Water Heaters, Inc., New York, N. Y.
Modine Mfg. Co., Racine, Wis.
Monitor Boiler Co., Philadelphia, Pa.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER, (CLOSED)
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E. Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Stanwood Corp., Cincinnati, Ohio.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER (OPEN)
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEATERS, FUEL-OIL
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Gar Wood Engineering Co., Detroit, Mich.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT
Air-Way Electric Appliance Corp., Toledo, Ohio.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.
Wing Mfg. Co., L. J., New York.
Wolverine Tube Co., Detroit, Mich.
Young Radiator Co., Racine, Wis.

HEATERS, UNIT GAS FIRED
General Gas Light Co., Kalamazoo, Mich.

HEATING SYSTEMS, GAS
Jas. B. Clow & Sons, Chicago, Ill.
Gar Wood Engineering Co., Detroit, Mich.
Roberts-Gordon Appliance Co., Buffalo.

HEATING SYSTEMS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR
American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, O.
Gorton Heating Corporation, New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, WATER
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.

HUMIDIFIERS
American Air Filters Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Woodward Co., Frank E., Boston, Mass.

HUMIDITY CONTROL
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING
Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P. Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.
(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING
Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
General Insulating & Mfg. Co., Alexandria, Ind.
Insulite Co., Minneapolis, Minn.
Johns-Manville Corp., New York, N. Y.

KETTLES, COPPER
Badger & Sons Co., E. B., Boston, Mass.

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical)

METALS, THERMOSTATIC
Chace Valve Co., W. M., Detroit, Mich.

METERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.

METERS, PITOT TUBE
Buffalo Forge Co., Buffalo, N. Y.

METERS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Builders' Iron Foundry, Providence, R. I.

METERS, WATER, GAS, OIL & AIR
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

MOTORS (ELECTRIC)
Baldor Electric Co., St. Louis, Mo.
Century Electric Co., St. Louis, Mo.
Emerson Electric Mfg. Co., St. Louis, Mo.
Janette Mfg. Co., Chicago, Ill.
Ohio Electric Mfg. Co., Cleveland, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

NOZZLES, SPRAY
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

OIL BURNERS
Carborundum Co., Perth Amboy, N. J.
Century Engineering Co., Cedar Rapids, Ia.
Electrol Inc., St. Louis, Mo.
Johnson Co., S. T., Oakland, Cal.
Silent Automatic Corp., Detroit, Mich.
Winslow Boiler & Eng. Co., Chicago, Ill.

OIL BURNER EQUIPMENT
Buffalo Forge Co., Buffalo, N. Y.
Cook Electric Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnston Bros., Inc., Ferrysburg, Mich.
Schutte & Koerting Co., Philadelphia, Pa.

OIL BURNER IGNITION AND CONTROL EQUIPMENT
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Time-O-Stat Controls Co., Elkhart, Ind.
White Mfg. Co., St. Paul, Minn.

OZONE APPARATUS
United States Ozone Co. of America, Scottdale, Pa.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING (WOOD)
American District Steam Co., North Tonawanda, N. Y.

PIPE, CAST-IRON
American Radiator Co., New York.
Walworth Co., New York.

PIPE HANGERS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.

PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.

PIPE, STEEL
Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

PULLEYS & SHEAVES
Pyott Foundry & Mch. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Trane Co., La Crosse, Wis.

PUMPS, CENTRIFUGAL, VACUUM HEATING
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.
Trane Co., La Crosse, Wis.

PUMPS, CONDENSATION
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Decatur Pump Co., Decatur, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.

PUMPS, OIL
Janette Mfg. Co., Chicago, Ill.

PUMPS, SUMP
Chicago Pump Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, TURBINE
Ames Pump Co., New York.
Decatur Pump Co., Decatur, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, VACUUM
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.

RADIATION, LIGHT WEIGHT, NON FERROUS
American Radiator Co., New York.
McQuay Radiator Co., Chicago, Ill.
The Herman Nelson Corp., Moline, Ill.
Rome Brass Radiator Corp., New York
Rome Turney Radiator Co., Rome, N. Y.
Trane Co., La Crosse, Wis.
Winchester Repeating Arms Co., New Haven, Conn.
Young Radiator Co., Racine, Wis.

RADIATOR ENCLOSURES AND SHIELDS
McQuay Radiator Corp., Chicago, Ill.

RADIATOR HANGERS
American Radiator Co., New York, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y.
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATOR TUBES, COPPER
Wolverine Tube Co., Detroit, Mich.

RADIATORS, CABINET AND CONCEALED
Air-Way Electric Appliance Corp., Toledo, Ohio.
Fintube Radiator Co., Long Island City, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
Rome Brass Radiator Corp., New York
Trane Co., La Crosse, Wis.
Young Radiator Co., Racine, Wis.

RADIATORS, CAST-IRON
American Radiator Co., New York, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.

RADIATORS, GAS-FIRED
American Radiator Co., New York, N. Y.
Jas. B. Clow & Sons, Chicago, Ill.

RADIATORS, VERTICAL FIN
Wolverine Tube Co., Detroit, Mich.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

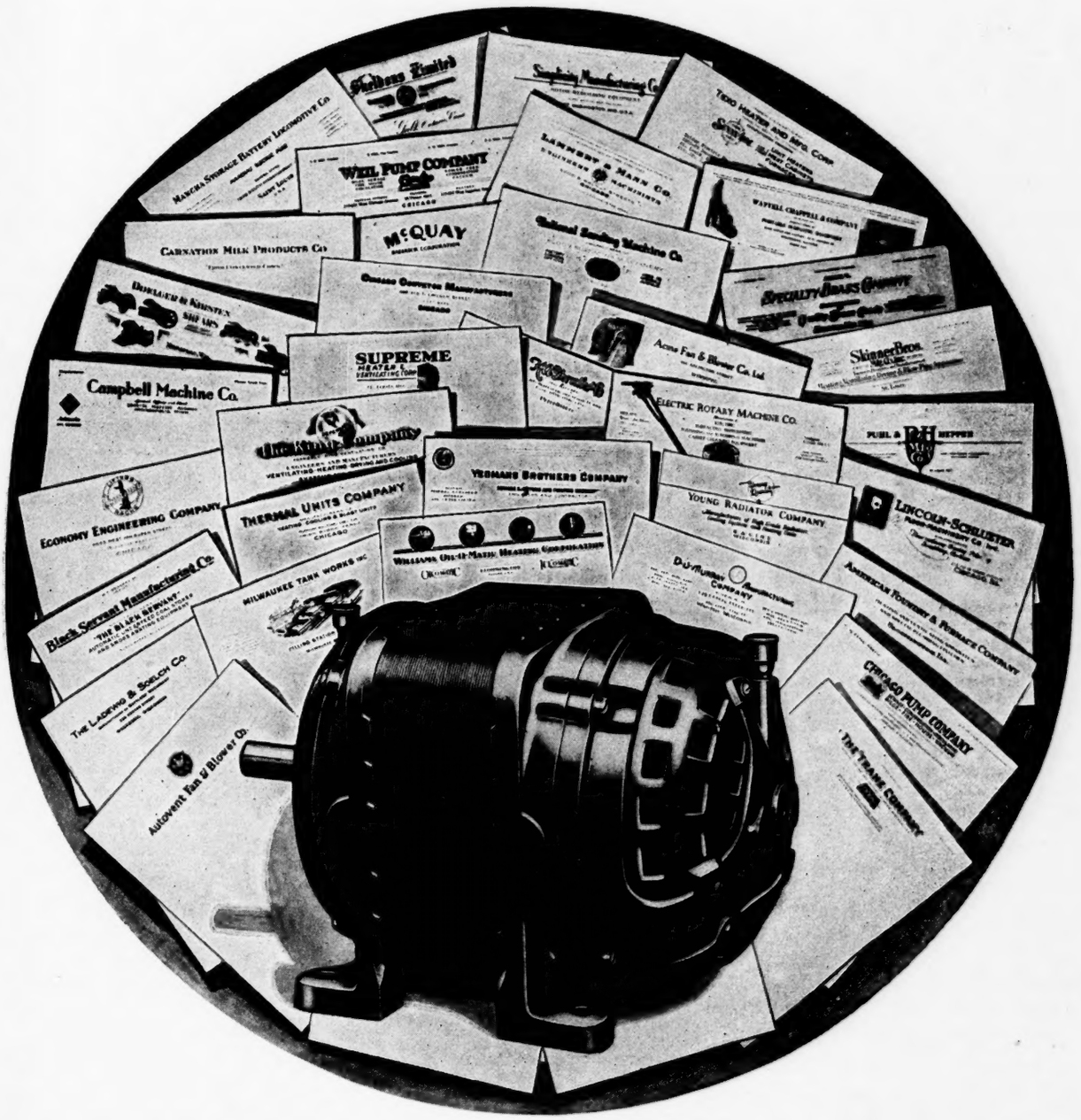
RECEIVERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Trane Co., La Crosse, Wis.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, DAMPER
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.

REGULATORS, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

REGULATORS, PRESSURE
American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.



National Leaders Choose Baldors!

THE above cross section of Baldor customers include many of the outstanding industries in America. Their use of Baldor Motors, which covers 17 basically different applications, range from Unit Heaters here, to Mining Machinery in Russia.

Many of the firms have been using Baldor Motors from 2 to 10 years. The experience of some of them has covered from 15,000 to 30,000 Baldor Motors.

Specializing from the first in ball bearing design which eliminates thrust and lubrication problems, Baldor has perfected its line to a point that only long experience could produce.

Baldor has added another feature of special advantage for makers of motor driven equipment — matched frame motors, in which the whole assembly is identical for all motors of a given rating and speed.

Ask for folder. Baldor Electric Co., 4356 F. Duncan Av., St. Louis, Mo. U.S.A.

BALDOR

A BETTER BALL BEARING MOTOR

Eliminates Thrust and Lubrication Problems

Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, TEMPERATURE
(See Temperature Control)

REGULATOR, WATER
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

SEPARATORS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J.

SEPARATORS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Webster & Co., Warren, Camden, N. J.

SPRAY COOLING SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES
(See Nozzles, Spray)

STERILIZER, WATER
U. S. Ozone Corp., Scottdale, Penn.

STOKERS, MECHANICAL
Brownell Co., Dayton, Ohio.
Detroit Stoker Co., Detroit, Mich.
Domestic Stoker Co., New York.
Whiting Corp., Harvey, Ill.

STRAINERS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, WATER
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

TANKS, COPPER
Badger & Sons Co., E. B., Boston, Mass.

TEMPERATURE CONTROL
American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark, N. J.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Sterling Engineering Co., Milwaukee, Wis.
Time-O-Stat Controls Co., Elkhart, Ind.
Trane Co., La Crosse, Wis.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.

THERMOMETERS, RECORDING AND INDICATING
American Radiator Co., New York, N. Y.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

THERMOSTATIC METAL
W. M. Chace Valve Co., Detroit, Mich.

THERMOSTATS
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Johnson Service Co., Milwaukee, Wis.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Time-O-Stat Controls Co., Elkhart, Ind.
White Mfg. Co., St. Paul, Minn.

TRAPS, BUCKET
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.

TRAPS, FLOAT
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, FLOAT & THERMOSTATIC
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

TRAPS, INVERTED BUCKET (STEAM AND AIR)
Armstrong Machine Wks., Three Rivers, Mich.

TRAPS, LIFTING
Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.

TRAPS, RADIATOR
American District Steam Co., North Tonawanda, N. Y.
Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Vapor Engineering Co., New York City.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS
Crane Co., Chicago, Ill.

TUBING, SEAMLESS, COPPER, BRASS AND ALUMINUM
Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNIT HEATERS
(See Heaters, Unit)

VACUUM CLEANING APPARATUS
American Radiator Co., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING
Crane Co., Chicago, Ill.

VALVES, AIR, AUTOMATIC
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

VALVES, AIR RELIEF
American Radiator Co., New York, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.
Trane Co., La Crosse, Wis.

VALVES, BACK PRESSURE
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, BALANCED
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, BLOW-OFF
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Walworth Co., New York.

VALVES, CHECK
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, DIFFERENTIAL RELIEF, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, FLOAT
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, GATE
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
Walworth Co., New York.

VALVES, GLOBE, ANGLE & CROSS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, HYDRAULIC-OPERATING
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Walworth Co., New York.

VALVES, MAGNETIC
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON BY-PASS
The Stack Heater Co., Boston, Mass.

VALVES, NON-RETURN
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Walworth Co., New York.

VALVES, RADIATOR
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Vapor Engineering Co., New York.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J.

VALVES, PRESSURE REDUCING
(See Regulators, Pressure)

VALVES, REGULATING
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Walworth Co., New York.

VALVES, RELIEF (WATER)
Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
The Stack Heater Co., Boston, Mass.

VALVES, SAFETY
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
The Stack Heater Co., Boston, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Walworth Co., New York.

VALVES, STOP AND CHECK
(See Valves, Non-Return)

VALVES, VACUUM RELIEF
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

VENTILATING SYSTEMS
American Blower Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
National Regulator Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

VENTILATORS
Bayley Blower Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

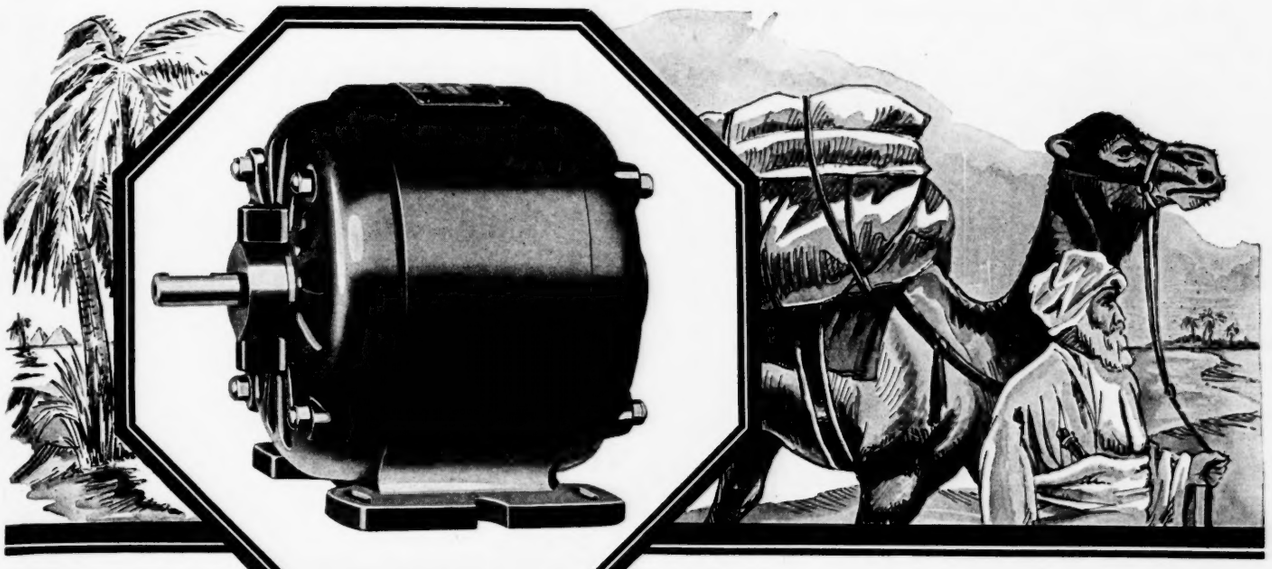
VENTILATORS, FLOOR
Aeolus Dickinson, Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF
Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT
Nelson Corp., Herman, The, Moline, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

WRENCHES, STILLSON
Walworth Co., New York.

ZONE HEATING SYSTEMS
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.



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and N. E. L. A. specifications
1/30 to 1 Horse Power

OHIO reliable MOTORS

THE OHIO ELECTRIC MFG. CO.

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Formerly THE OHIO ELECTRIC & CONTROLLER CO.

OHIO MOTORS

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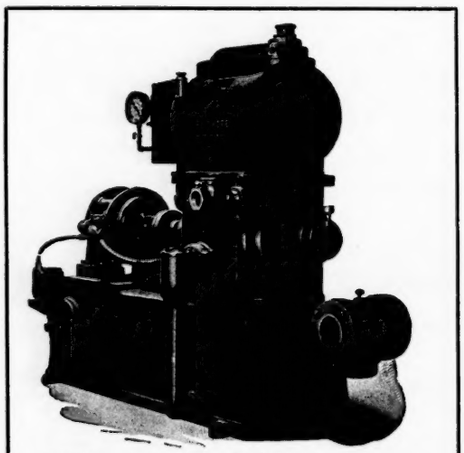
Skidmore Vacuum Pumps



Skidmore Automatic Vacuum Pump

are capable of handling such a surplus capacity of air and water that the efficient operation of the unit on any reasonable job is a certainty.

(WRITE FOR BULLETIN NO. 6)

SKIDMORE CORPORATION

1535 DAYTON STREET, CHICAGO

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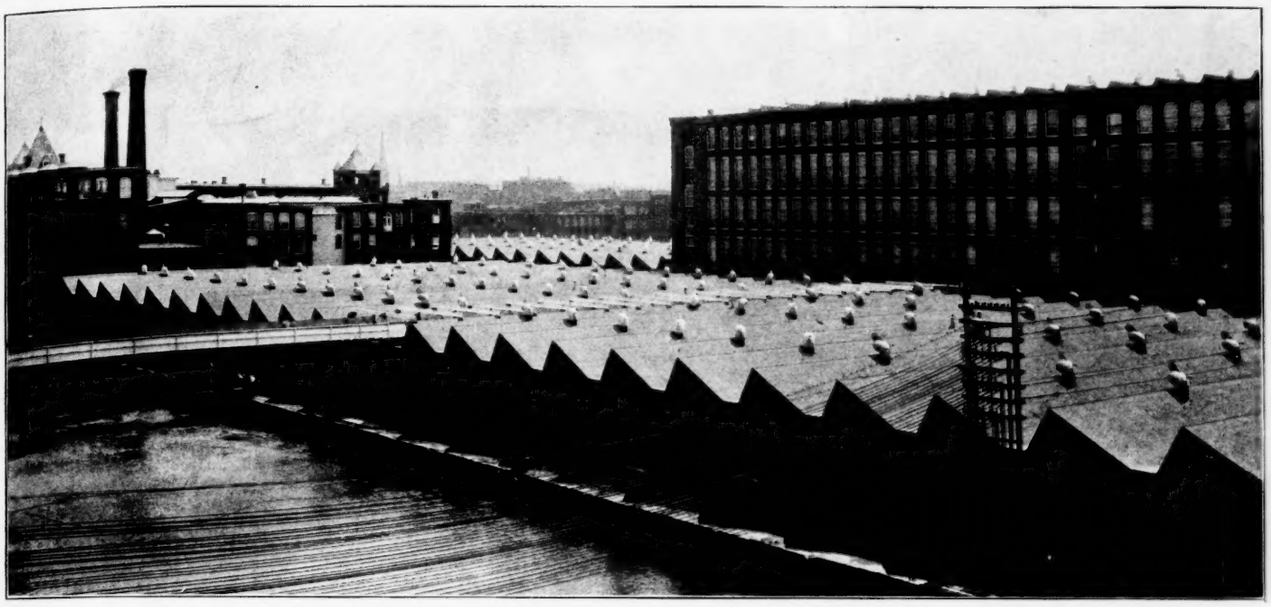

THE FARR ALPACA MILLS—HOLYOKE, MASSACHUSETTS

In textile mills comfortable working temperatures must be maintained under adverse conditions. Here Celotex Roof Insulation Board increases production per labor hour but reduces winter heating costs.

Shut out scorching summer heat

and cut winter heating costs

IT'S easy to maintain comfortable, even working temperatures in buildings with Celotex insulated roofs.

Heating engineers insure more efficient operations by protecting workers from sweltering summer heat with Celotex Roof Insulation Board.

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You can heat buildings properly with smaller heating plants and less radiation when you specify the use of Celotex. Fuel costs are much lower.

The actual savings secured have been proved time and again in many types of industrial buildings.

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Serious losses from ceiling condensation are eliminated—by always keeping ceilings well above the dew point. And the hazard from contraction and expansion of roof decks is greatly reduced.

Heating engineers and architects prefer Celotex Roof Insulation Board not only because of its great efficiency but because it costs so little to apply—on old or new buildings.

The boards can be laid over any type of roof deck or right over the old built up roofing.

Technical data on the actual savings that Celotex Roof Insulation Board insures have been carefully tabulated for quick reference.

Write for *Dividends from Proper Roof Protection.* You'll find it invaluable in your work. The cooperation of our engineers is always yours for the asking.

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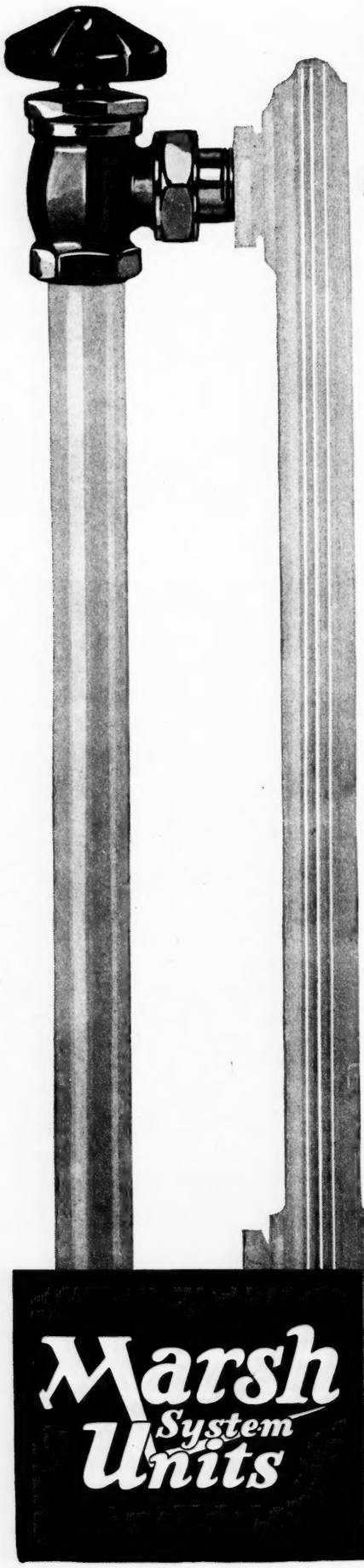

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presents truly modern heating

. . . matched units

The creation of matched radiator units in the modern manner is typical of the progressive quality of Marsh engineering.

From the ultra modern, hand-fitting, handsome, Bakelite wheel to the base of the trap, these units . . . set off by an enduring two-tone finish of lustrous chromium . . . blend harmoniously with the finest interiors, whether of homes or of public buildings.

Marsh engineering for sixty-five years has contributed to the increased efficiency and economy of heating systems. It is natural that Marsh products should be chosen on the most modern buildings for their superiority of interior design, smooth operation and sturdy construction.

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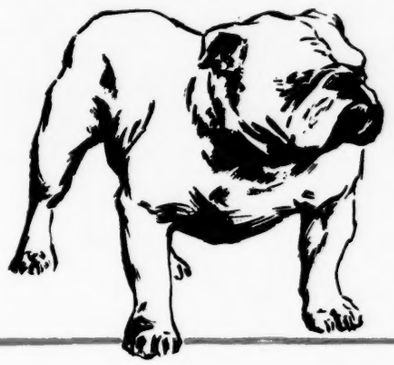
FAMOUS FIGHTERS



Bulldog

(An English Variety of the Common Dog)

The bulldog originated in England. It was first developed for the sport of bull baiting. The worrying of a bull required a dog of ferocious courage. The instinctive habit of seizing the enemy by the nose and indomitable strength and tenacity of jaw were also important characteristics. The modern breed of bulldog first began to be recognized early in the 17th century. After the extinction of bull baiting, these dogs were reared for fighting in dog pits. More recently they have been bred for watch dogs. The bulldog is faithful to his owner and protects his property jealously.

Weil-McLain Boilers are *fighters*, too!

Weil-McLain fighting features are *selling* features because they fight fuel waste and deliver more heat. It is easy to show home owners why Weil-McLain Boilers will save them money and protect them from discomfort. That's why Weil-McLain Boilers are good business builders for you.

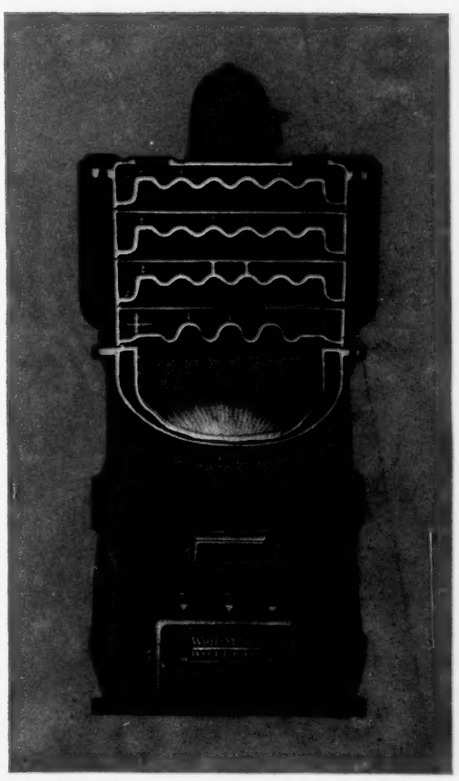
Fuel-saving corrugations like this ∿∿∿

The Weil-McLain Round Boiler, for example, delivers more heat and saves fuel, because all the vital heat-absorbing surfaces are corrugated like this ∿∿∿ instead of flat like this ———. It is easy to show that the wavy line crowds 30 to 40 per cent more heating surface into the same space.

Balanced back-and-forth fire travel

More heat is actually utilized in Weil-McLain Boilers because Weil-McLain fire travel is not only back and forth but it is *balanced*. Variations in the rate at which boilers operate, due to varying heat demands, do not alter the long, balanced, back-and-forth flow of gases through the flues.

In the complete line of Weil-McLain Boilers you will find scientific principles of design that enable these boilers to fight fuel waste and deliver more heat. The line includes Round Type, Jacketed, Square, Self-feed and Smokeless Boilers. Also Weil-McLain "Cameo" Radiators.



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Boiler Plant and Offices: Michigan City, Ind.
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Jobbing Distributors with local stocks in most jobbing centers

Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS

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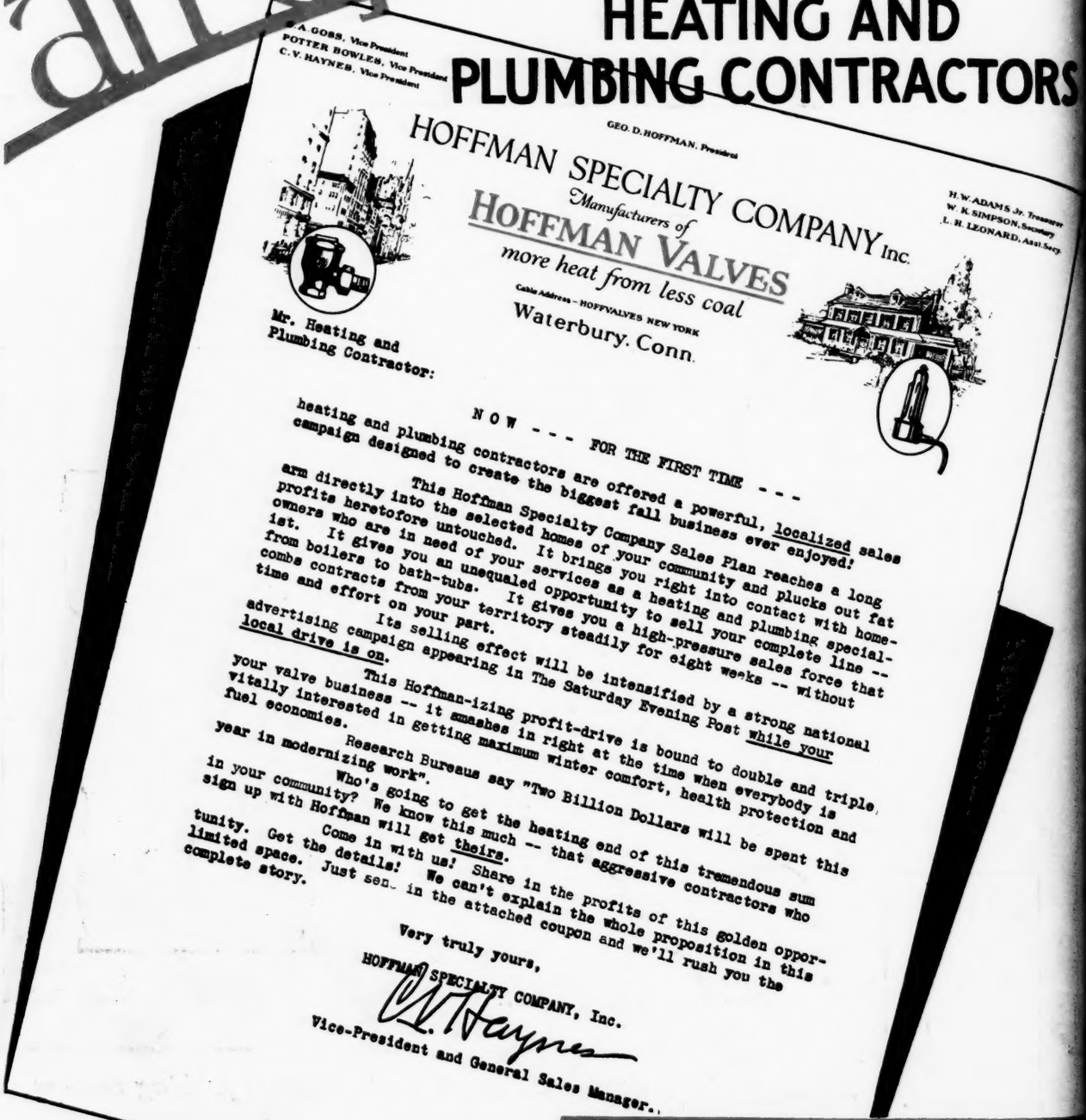
fight fuel waste and deliver more heat

an·open·letter *to all* HEATING AND PLUMBING CONTRACTORS



A. GOSS, Vice President
POTTER BOWLES, Vice President
C. V. HAYNES, Vice President

GEO. D. HOFFMAN, President

HOFFMAN SPECIALTY COMPANY Inc.
Manufacturers of
HOFFMAN VALVES
more heat from less coal
Cable Address – HOFFVALVES NEW YORK
Waterbury, Conn.

H. W. ADAMS Jr. Treasurer
W. K. SIMPSON, Secretary
L. H. LEONARD, Asst. Secy.

Mr. Heating and
Plumbing Contractor:

N O W - - - FOR THE FIRST TIME - - -

heating and plumbing contractors are offered a powerful, localized sales campaign designed to create the biggest fall business ever enjoyed!

This Hoffman Specialty Company Sales Plan reaches a long arm directly into the selected homes of your community and plucks out fat profits heretofore untouched. It brings you right into contact with home-owners who are in need of your services as a heating and plumbing specialist. It gives you an unequaled opportunity to sell your complete line -- from boilers to bath-tubs. It gives you a high-pressure sales force that combs contracts from your territory steadily for eight weeks -- without time and effort on your part.

Its selling effect will be intensified by a strong national advertising campaign appearing in The Saturday Evening Post while your local drive is on.

This Hoffman-izing profit-drive is bound to double and triple your valve business -- it smashes in right at the time when everybody is vitally interested in getting maximum winter comfort, health protection and fuel economies.

Research Bureaus say "Two Billion Dollars will be spent this year in modernizing work".

Who's going to get the heating end of this tremendous sum in your community? We know this much -- that aggressive contractors who sign up with Hoffman will get theirs.

Come in with us! Share in the profits of this golden opportunity. Get the details! We can't explain the whole proposition in this limited space. Just send in the attached coupon and we'll rush you the complete story.

Very truly yours,

HOFFMAN SPECIALTY COMPANY, Inc.

C. V. Haynes

Vice-President and General Sales Manager.

Mail This Today!
for Complete Plan

Sales Campaign Manager
HOFFMAN SPECIALTY COMPANY, INC.
Waterbury, Conn.

Yes! I want to join the Hoffman Drive for Bigger Fall Business. Rush me the details—no obligation.

Name.....

Address.....

City..... *State*.....